Installation Manual *for*

"C" SERIES HORIZONTAL

AIR CONDITIONING UNITS

1 Ton – 15 Ton

Air-Cooled • Water-Cooled • Heat Pump

590A

UNITED COOLAIR

CORPORATION

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AIR-COOLED 1 THRU 15 TONS

Labeled & Listed

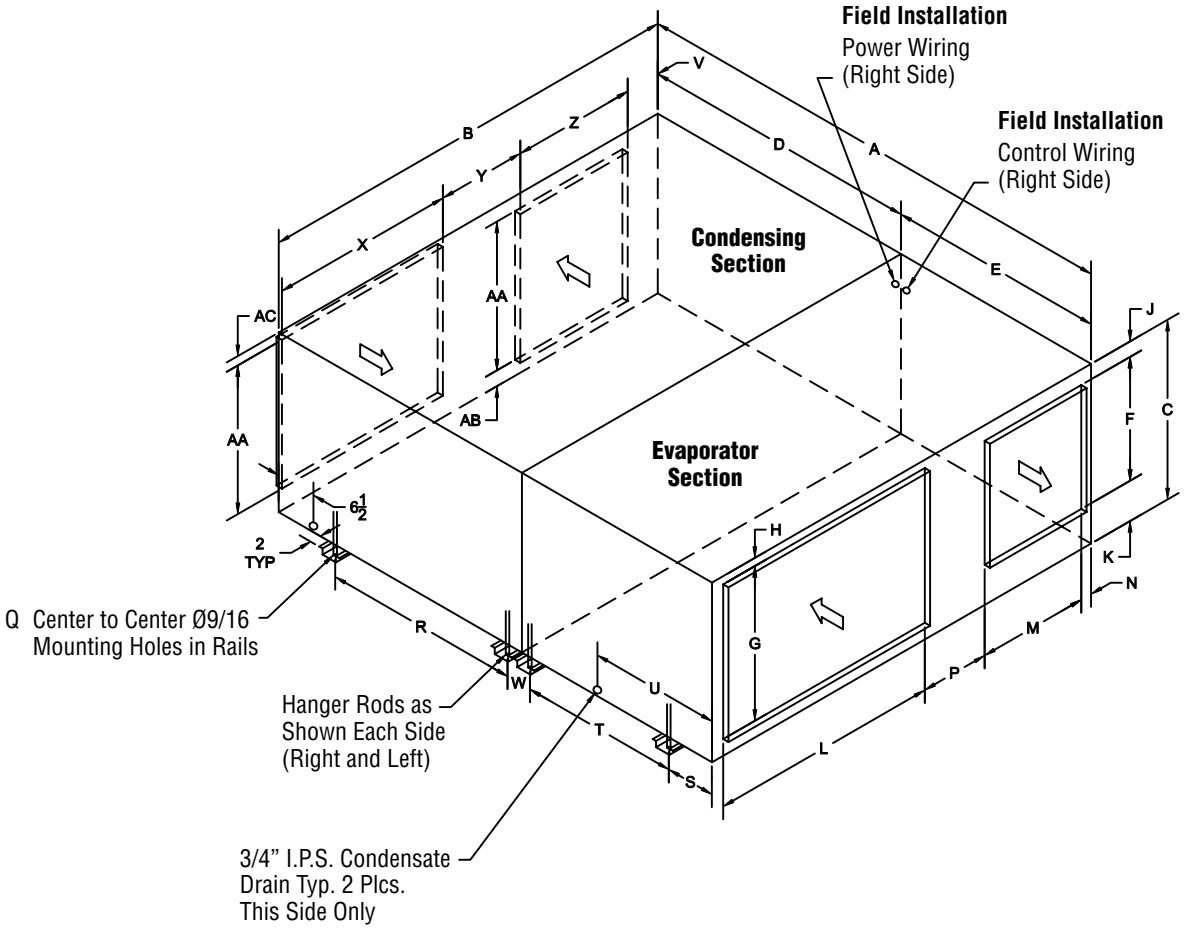


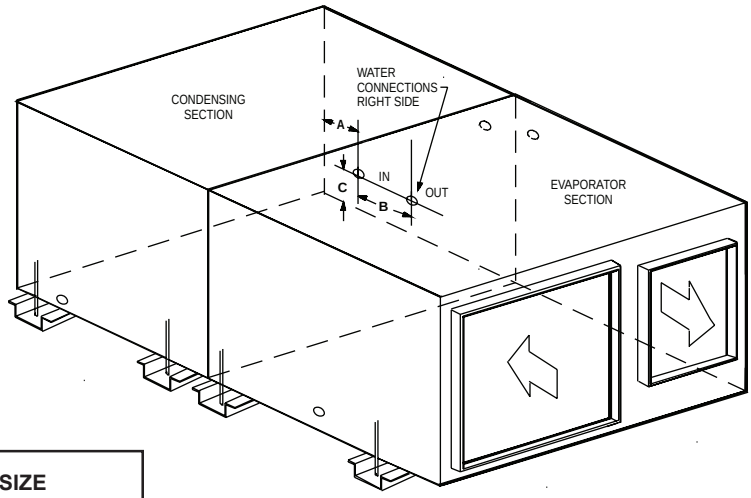
Figure 1: Dimensional Drawing

TONS	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
10-15	80 3/4	70 5/8	29	45 5/16	35 7/16	20	25	1 5/16	2 1/2	6 1/2	37 9/16	18	1 7/8	11 3/16	72 1/16	32 1/8	7 3/8	25 7/8	21 5/16	5 5/8	4 3/16	30	14 7/16	20	24	3 1/2	1 1/2
4-8	71 3/4	55 3/8	27	40 3/8	35 7/16	18	23	1 5/16	3 5/8	5 3/8	32	16	3	2 5/16	56 3/4	27 1/4	7 5/16	21 1/16	20 11/16	3 11/16	4 1/16	18	15 1/16	18	20	4 11/16	2 9/16
2-5	66 5/16	47 3/8	22	34 3/4	31 9/16	16	18	1 5/16	3/4	5 1/4	24	16	3	2 5/16	48 3/4	21 9/16	7 3/8	22 1/16	20 3/4	4 11/16	4 1/8	16	10	16	16	4 11/16	1 3/16
1-1.5	51 5/8	35 15/16	16	29 9/16	22 1/16	12	12	1 5/16	1	3	16 1/8	12	4 1/16	2 5/16	37 5/16	25 1/4	4 3/4	15 1/4	14 3/4	4 15/16	4 1/8	12	6 1/4	12 1/16	12	2 3/4	1 1/4

Figure 2: Dimensional Table

WATER-COOLED 1 THRU 15 TONS

FIGURE 3: Water-Cooled Water Connections



NOTE: CONDENSATE DRAIN MUST BE PIPED IN BOTH EVAPORATOR AND CONDENSING SECTIONS.

UNIT	A	B	C	PIPE SIZE
1 and 1-1/2 Ton Single Circuit	5"	5"	3-1/16"	IN & OUT 7/8" O.D.
2 thru 4 Ton Single Circuit	3-1/4"	13"	3-3/4"	IN & OUT 7/8" O.D.
5 Ton Single Circuit	3-1/4"	13"	3-3/4"	IN & OUT 1-1/8" O.D.
4 thru 8 Ton Dual Circuit	4-1/2"	13"	3-3/4"	IN & OUT 1-1/8" O.D
10 Ton Dual Circuit	4-1/8"	14"	3-3/4"	IN & OUT 1-3/8" O.D
12 thru 15 Ton Triple Circuit	4-1/8"	14"	3-3/4"	IN & OUT 1-3/8" O.D

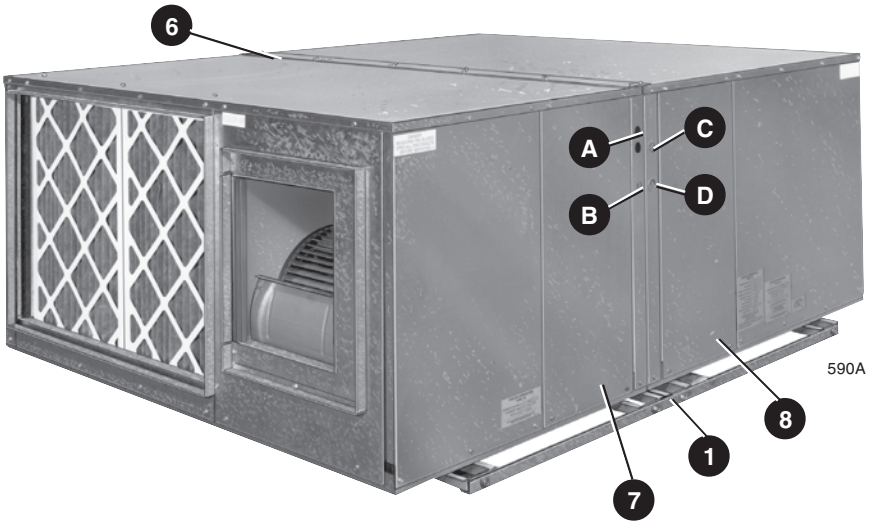
CSA®

MET®
Listing
for Water Cooled or
Heat Pump Units

FIGURE 4: Approximate Net Weights

	TOTAL UNITS		CONDENSING SECTION ONLY	
	AIR-COOLED	WATER-COOLED	AIR-COOLED	WATER-COOLED
1 TON	415 lbs.	395 lbs.	250 lbs.	230 lbs.
1-1/2 TON	430 lbs.	410 lbs.	290 lbs.	270 lbs.
2 TON	665 lbs.	605 lbs.	395 lbs.	335 lbs.
3 TON	685 lbs.	625 lbs.	390 lbs.	330 lbs.
4 TON SINGLE COMP.	700 lbs.	640 lbs.	415 lbs.	355 lbs.
4 TON DUAL COMP.	950 lbs.	905 lbs.	570 lbs.	525 lbs.
5 TON SINGLE COMP.	720 lbs.	660 lbs.	425 lbs.	365 lbs.
5 TON DUAL COMP.	970 lbs.	925 lbs.	585 lbs.	540 lbs.
6 TON DUAL COMP.	970 lbs.	925 lbs.	585 lbs.	540 lbs.
8 TON DUAL COMP.	995 lbs.	945 lbs.	600 lbs.	550 lbs.
10 TON DUAL COMP.	1340 lbs.	1205 lbs.	800 lbs.	665 lbs.
12 TON TRIPLE COMP.	1520 lbs.	1375 lbs.	915 lbs.	770 lbs.
15 TON TRIPLE COMP.	1580 lbs.	1450 lbs.	950 lbs.	820 lbs.

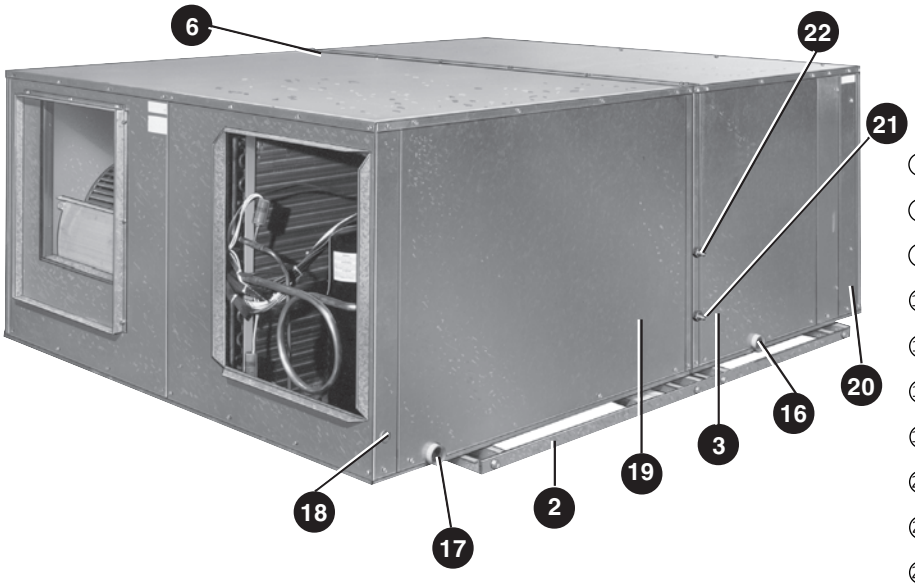
UNIT COMPONENTS



LEGEND OF ITEMS

①	Tie Rail
⑥	Unit Top Tie Piece
⑦	Access Panel, Evaporator Box
⑧	Access Panel, Condenser Box
Ⓐ	Thermostat Wiring Connection
Ⓑ	Power Wiring (Split-Unit – Evaporator Section)
Ⓒ	Low Voltage Wiring Connection
Ⓓ	Power Wiring Connection (for package units and for condensing sections in split systems).

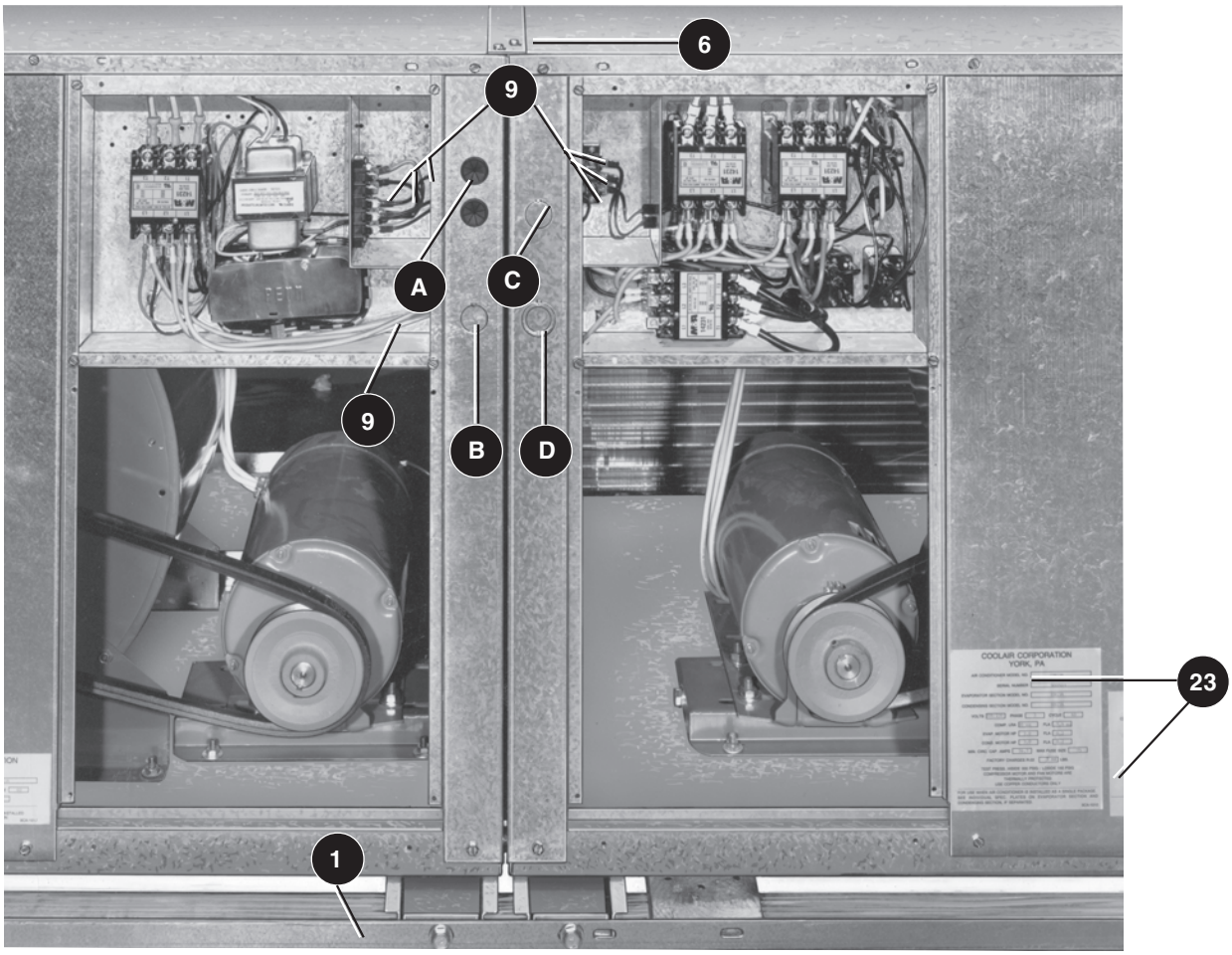
Figure 5: Unit (toward evaporator section and right side)



LEGEND OF ITEMS

②	Tie Rail
③	Evaporator Access Panel
⑥	Unit Top Tie Piece
⑯	Evaporator Condensate Drain
⑰	Condenser Drain
⑱	Grommet, Low Ambient Tube
⑲	Condenser Access Panel
⑳	Filter Access Panel
㉑	Condensate Pump Connection
㉒	Humidifier Connection

Figure 6: Unit (toward condensing section and left side)



LEGEND OF ITEMS

①	Tie Rail
⑥	Unit Top Tie Piece
⑨	Wires to Disconnect (Split-unit)
㉓	Specification Plates
Ⓐ	Thermostat Wiring Connection (for both package and split units)
Ⓑ	Power Wiring (for unit evaporator)
Ⓒ	Low Voltage Wiring Connection
Ⓓ	Power Wiring Connection

Figure 7: Right Side (with control box access panels and control box covers removed)

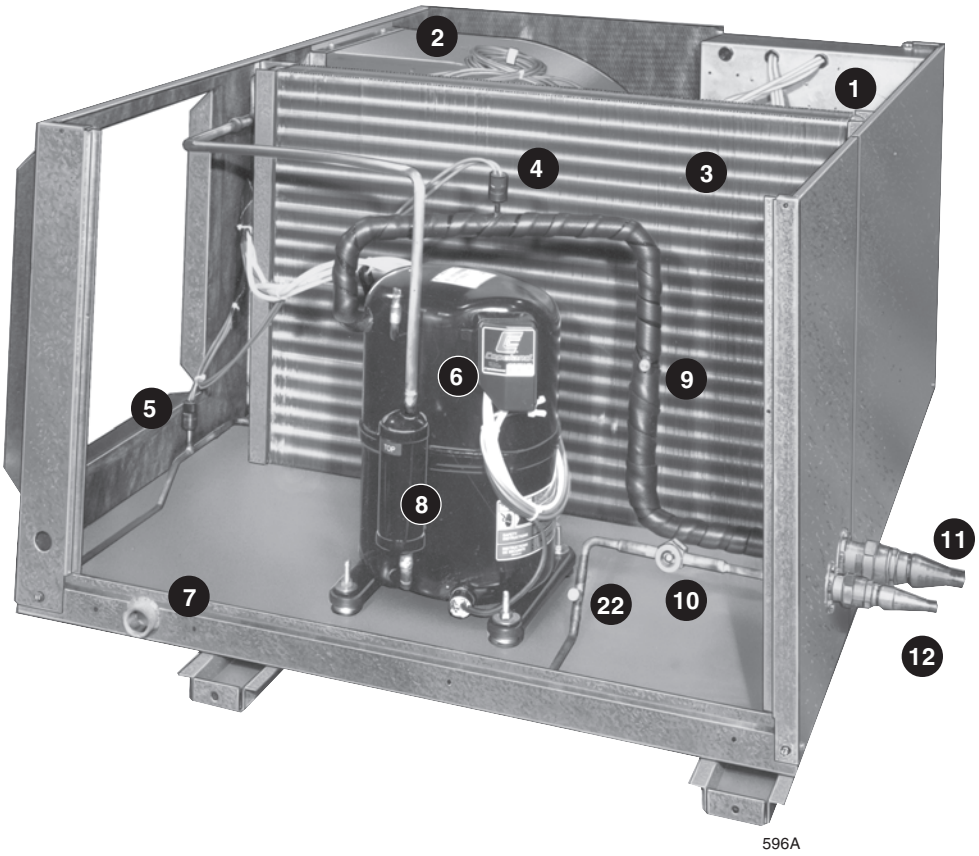


Figure 8: Split Unit (Condensing Section)

Note: Air Switch (filter differential) located in same area as 21.

LEGEND

1. Electrical Control Box (condenser)
2. Condenser Blower
3. Condenser Coil
4. Low Pressure Control
5. High Pressure Control
6. Compressor
7. Condenser Drain Connection
8. Muffler
9. Suction Service Port
10. Sight Glass
11. Self-sealing Coupling (suction line)
12. Self-sealing Coupling (liquid line)
13. Evaporator Drain Connection
14. Filter-drier
15. Thermal Expansion Valve
16. Evaporator Coil
17. Air Filter
18. Evaporator Blower
19. Evaporator Motor
20. Electrical Control Box (Evaporator)
21. Air Switch (used only when Electric Heat is incorporated)
22. Liquid Service Port

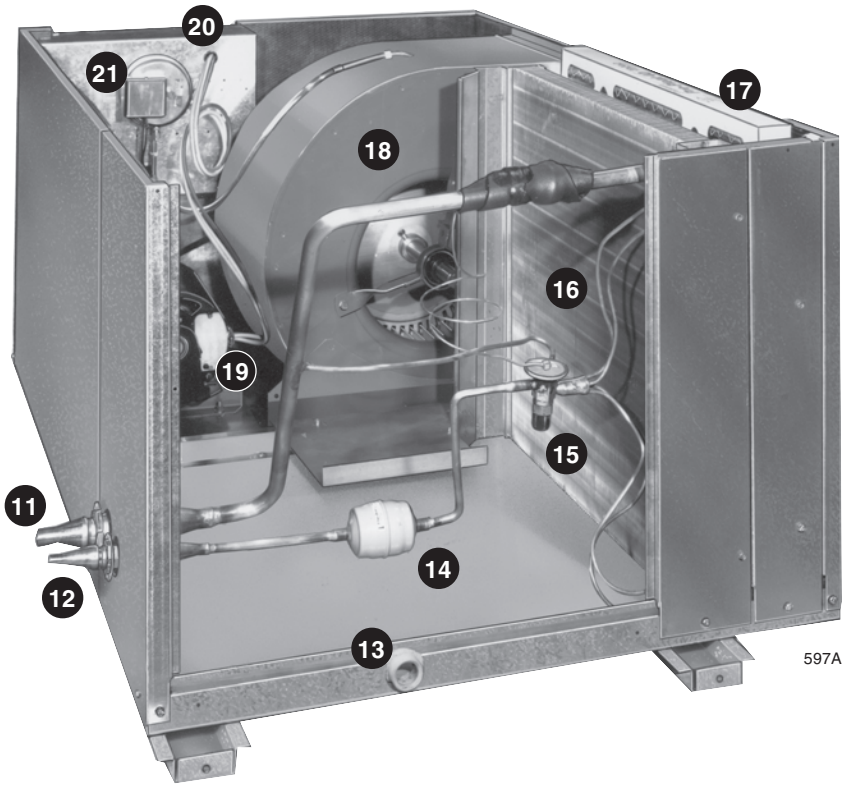


Figure 9: Split Unit (Evaporator Section)

GENERAL INFORMATION

INSPECTION OF EQUIPMENT

Upon receipt of the unit, inspect for visible or concealed damage. Report any damage to the carrier, and file a damage claim.

HANDLING

To facilitate handling, the unit is set on a wooden skid so that it may be picked up with a two-wheel hand truck or fork lift. Under no circumstances should the unit be "walked" on the corners of the skid. Use dolly trucks or pipe rollers to move the unit to its proper location.

LOCATION

Unit can be installed either as a complete package or split into two sections. It can be either floor mounted or ceiling mounted.

Before unit is installed, a thorough study should be made of the structure. Careful consideration must be given to location of wiring, condensate disposal, ductwork and accessibility to the unit for maintenance and servicing. It is necessary that a minimum clearance space be allowed on each side of the unit to accommodate maintenance and servicing. This minimum clearance must be 18" for the 1 and 1-1/2 Ton units and 26" for all larger units. Attention must also be given to floor, ceiling or wall load limitations (See Figures 1 and 2). Location should also provide for condensate removal, trapping and disposal.

! Discharge Air from condenser coil should be deflected away from supply air to condenser, to prevent recirculation. See also "Condensing Section Outdoor Modification Kit" on page 30.

! CAUTION: Unit should NOT be located in space subjected to freezing temperatures.

MOUNTING AND SETTING IN PLACE

Units can be shipped as an integral package with a tie rail [Items ① and ②; Figures 5, 6 & 7] attached to both sides of the unit at each of the four mounting channels.

If unit is not to be split but is to be hung, **do not** remove tie rail. Use field supplied (3/8" minimum diameter) hanging rods, with proper washers and locknuts, then elevate unit to the exact location where it is to be installed. Fasten the rods securely to the supporting structure using vibration isolator-type mounts, and level as required.

If unit is to be floor mounted and not separated, **do not** remove tie rails. Locate on a level pad and secure, using vibration isolators. See Figures 5, 6 and 7, Items ① and ②.

INSTALLATION

1. Air conditioner is shipped assembled and ready for operation.
2. Unit contains a full charge of R-22 refrigerant.
3. Evaporator section must be mounted so that there is a 0.375" to 0.5" tilt down toward the condensate drain connection. This is to ensure that the water drains to the condensate removal point (See Figure 10).

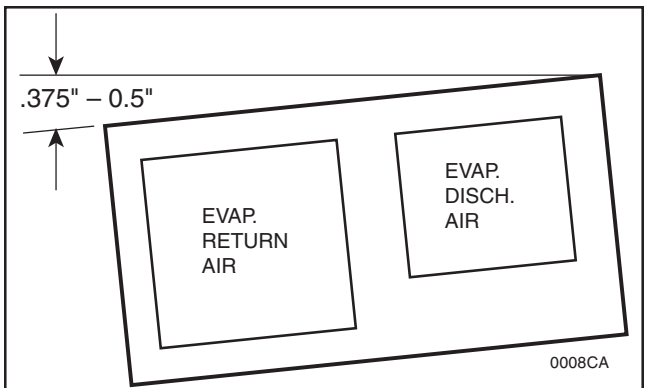


FIGURE 10: Tilting The Evaporator Section

4. Install unit so that controls and side panels are accessible to the operator and maintenance personnel.
5. Run the condensate drain line by following the guidelines on page 15.
6. Electrical Wiring
   a. Once the unit is installed, refer to the wiring diagrams which are provided on the backside of the covers of the control boxes. (See Figure 7.)
   b. Units are completely internally wired at the factory for commonly rated supply voltages. Check unit specification plates close to outer access panels for required voltage, wire and fuse sizing (see Item ㉓, Figure 7). The factory wiring terminates in two boxes; one each in the evaporator and condensing sections. These control boxes are located behind the outer access panels, Item ⑦ and Item ⑧ in Figure 5. Each is supplied with an individual control box cover with a wiring diagram attached inside.
   c. All the units are provided with terminal blocks.
   d. The power wiring to the unit is brought through the holes marked on the unit for electrical power connections. See Figure 7.
   e. The control wiring is brought through the holes provided in the unit: Item Ⓓ for integrated units and Items Ⓑ & Ⓓ for split units. See Figure 7.
   f. Supply wiring must comply with all National or Local codes. The power supply must be suitably fused or protected.
   g. Use copper conductors only. The unit must be earth grounded using the ground lug provided in the electrical box.
7. Run the low voltage wiring from the thermostat to the unit. Connect to low voltage terminal block supplied. See "Thermostat" under "Options", page 25.

   Properly locate thermostat to avoid vibration, drafts, sun exposure, or internal heat sources. Use an inside wall.

Wire Size[1] AWG. Gauge				
22	20	19	18	16
40	120	150	190	305
Maximum Wire Length[2] Feet				

Notes:
1. Solid, Class II copper wire
2. Based on a voltage drop of 1.2 volts per wire.
3. Total wire length is from unit to room thermostat, and back to unit.

FIGURE 11: Control Wire Sizes

COMPRESSOR MOUNTING – WARNING

Compressors on some units are spring mounted but are tightened down for shipping. Before initial start-up, compressor nuts must be backed-off to the point where they are flush with the top of the studs. FAILURE TO DO SO WILL CAUSE UNNECESSARY VIBRATION.

SEPARATION OF SECTIONS

If the unit is to be installed as a split system, the following steps must be carefully followed in performing the separation.

1. Remove evaporator access panel (Item ③, Figure 6).
2. Using an open-end wrench and turning counterclockwise, disconnect the female half of the self-sealing couplings on both the suction and discharge lines (Items ⑪ and ⑫, Figure 9). These are located in the bottom left area of the evaporator section. When there is a hot gas bypass option, that connection is to the right of the self-sealing coupling connections. There is one suction line, one liquid line, and one hot gas bypass line (option) for each compressor. See Figures 8 and 9.

Two circuit units have 2 groups of couplings; three circuit units have 3 groups. It's a good idea to label or mark the various connections on both the evaporator and condensing sections BEFORE DISCONNECTING THE

COUPLINGS to eliminate the possibility of intermixing the circuits when the interconnecting tubing is installed. The suction and discharge lines in the evaporator section will now be dangling, so be careful you don't damage the tubing connections. Do not disconnect the male half of the self-sealing couplings (Item ⑤, Figure 12), which are still attached to the bulkhead of the condensing section.

3. Remove the unit top tie piece* (Item ⑥, Figures 5, 6 & 7), removing only those screws which attach the top piece to the two top panels. (*If unit is already shipped split, these are not included.)
4. Remove control box access panels from the evaporator section (Item ⑦, Figure 5), and the condensing section (Item ⑧, Figure 5), by removing the screws at the top and bottom of each access panel.
5. Disconnect and discard the wires which run between the two internal control boxes (Item ⑨, Figure 7). Single circuit units will have two low

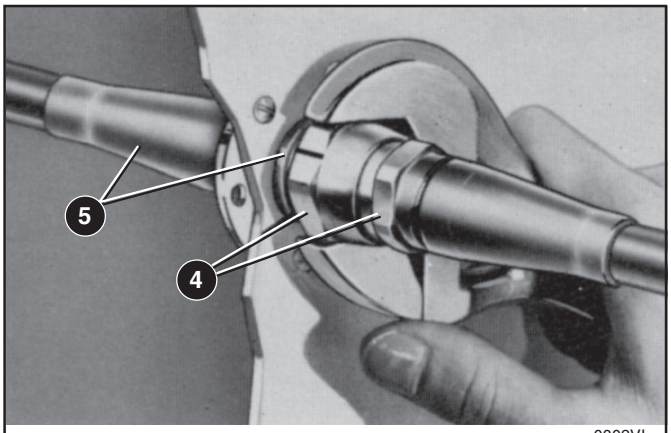


FIGURE 12: Disconnect/Connect Self-sealing Coupling

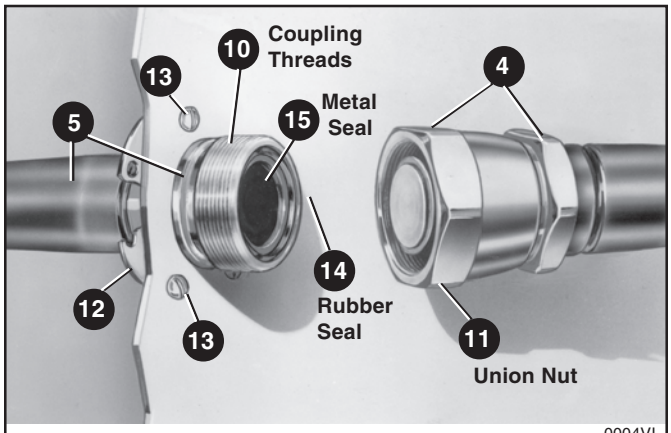


FIGURE 13: Install/Service Self-sealing Coupling

For Legend of Items, See Figure 14

FIGURE 14: Bill of Material for Each Interconnect Tubing Kit[1]
For 2 Ton thru 15 Ton Units (applies only to a matched "C" series evaporator and condensing section) [Items in brackets are for Hot Gas Bypass Kit]

ITEM #	QUANTITY	DESCRIPTION
—	4 [2]	Schrader Access Valves
④	1	Self-Sealing Coupling, Female Half (for suction line – outside of condensing section)
④	1 [1]	Self-Sealing Coupling, Female Half (for discharge line – outside of condensing section)
⑤	1	Self-Sealing Coupling, Male Half (for suction line – outside of evaporator section)
⑤	1 [1]	Self-Sealing Coupling, Male Half (for discharge line – outside of evaporator section)
⑫	1 [1]	Self-Sealing Flange (for holding male half on discharge line to outside of evaporator section)
⑫	1	Self-Sealing Flange (for holding male half on suction line to outside of evaporator section)
⑫	12 [6]	#10 x 3/8" SMS Slotted Hex Head Screws (for fastening flanges to outside of evaporator)

[1] For single circuit, use one kit; for dual circuits, use two kits; for triple circuits, use 3 kits.

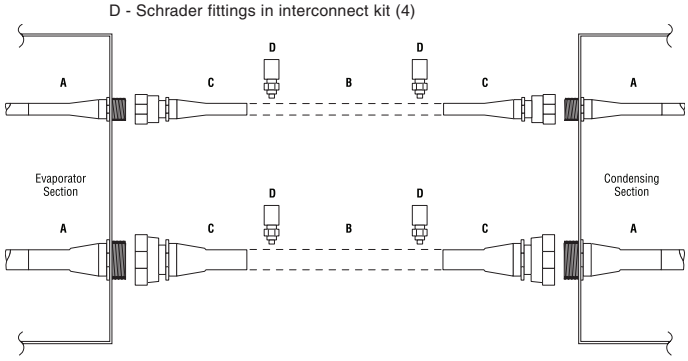
FIGURE 15: Guidelines for Interconnecting Tubing Sizing

Always follow accepted industry practices for sizing lines based on line length and elevation differences.

Max. total equivalent line length = 100 ft. (a)
Max. elevation difference between Evap. and Cond. = 40 ft. (a) (b)

TONS	SUCTION LINE	LIQUID LINE
1 Ton	5/8	3/8
1.5 Ton	3/4	3/8
2 Ton	3/4	1/2
3 Ton	7/8	1/2
4 Ton Single	1-1/8	1/2
4 Ton Dual	(2) 3/4	(2) 1/2
5 Ton Single	1-1/8	5/8
5 Ton Dual	(2) 7/8	(2) 1/2
6 Ton	(2) 7/8	(2) 1/2
8 Ton	(2) 1-1/8	(2) 1/2
10 Ton	(2) 1-1/8	(2) 5/8
12 Ton	(3) 1-1/8	(3) 1/2
15 Ton	(3) 1-1/8	(3) 5/8

The drawing below illustrates a typical piping arrangement
A - Male self-sealing fittings on unit sections
B - Refrigerant piping between sections (field-supplied)
C - Female self-sealing fittings in interconnect kit (4)
D - Schrader fittings in interconnect kit (4)



(a) Contact the factory for installations with elevation differences greater than 40 feet or total equivalent line lengths greater than 100 feet. Alternate line sizes and specific refrigerant components may be required.
(b) If condensing section is 20 feet or more above the evaporator include an oil seperator for each circuit.

United CoolAir Corporation's C-Series horizontal units are provided with unique self-sealing fittings on the refrigerant lines between sections. These fittings or couplings allow the two-unit section to be separated and reconnected without loosing refrigerant charge.

When installed as a split system, an interconnect kit is required for each refrigerant circuit or hot gas bypass line.

If the unit is defined as a split system when ordered, the fittings will be male fittings on both sections. The interconnect kit will then consist of the matching female fittings. The interconnect kit is required for the field to connect refrigerent lines between both sections. Refrigerant piping between the sections is field supplied.

The interconnect kit also contains four (4) Schrader fittings. The installer can place at least one in each refrigerant line or at the end of the refrigerant line. These enable the refrigerant line to be evacuated and charged as needed based on size and length.

In some situations, the desired refrigerant line size may differ from the self-sealing fitting size provided. The line size should be reduced or enlarged at the fittings as necessary.

voltage wires to be disconnected, dual and triple units will have 3 low voltage wires. See Wiring Diagram on the inside of the evaporator control box access panels (Item ⑦, Figure 5) for disconnecting power wiring.

6. Remove the two side cross-member angles (Item ①, Figures 5 and 7; and Item ②, Figure 6).
7. Carefully pull the evaporator section away from the condensing section. Double check that the self-sealing couplings are completely disengaged.

The sections may now be moved to their individual locations, either floor-mounted or hung.

INTERCONNECTING REFRIGERANT TUBING

After the separated sections have been installed, the interconnecting tubing can be run, using the self-sealing couplings supplied in the interconnect tubing kit (See Figure 14). For dual circuits, 2 kits are supplied; for triple circuits, 3 kits are supplied. It is recommended that some refrigerant oil be placed on the coupling threads (Item ⑩, Figure 13), to facilitate threading. The following instructions apply:

1. Hand thread the female halves (Item ④, Figures 12 and 13) of the self-sealing couplings (supplied with the interconnect tubing kit, Figure 14) onto the male couplings (still fastened to the condens-

ing unit, Item ⑤, Figures 12 and 13). Turn union nut (Item ⑪, Figure 13), approximately 1 to 1-1/2 turns. This is to make sure that the interconnecting tubing will be routed and brazed with the self-sealing couplings in their final proper location, so that there will be no difficulty when the final coupling assembly is made.

2. Attach the male couplings (same as Item ⑤, supplied with the interconnecting tubing kit) to the outside of the back panel of the evaporator section at the location vacated by the original couplings, using the flanges (Item ⑫) and screws (Item ⑬) provided in the kits (See Figures 13 and 14). The panel has holes to accept the screws (Item ⑬) to be utilized. Mount male coupling halves, same as Item ⑤, by sliding the flanges (Item ⑫, from interconnect kit) over end of couplings **before brazing tubing** and attach with screws (Item ⑬) to outer back panel of evaporator section. Do not connect female half of couplings (Item ④, still dangling inside evaporator section) until brazing is complete. If there is a hot gas bypass option, connect that coupling the same way.
3. Run the interconnecting tubing required.

! NOTE: Installations may be made with up to 100 feet equivalent line lengths by installing the recommended tube sizes (See Figure 15) and adding the necessary refrigerant, R-22 (See Step 7, page 14). For equivalent line lengths greater than 100 ft., contact the factory for line sizing and additional accesories required.

! IMPORTANT! On units with more than one refrigerant circuit, be careful not to intermix lines of the various circuits. If the connections were labeled before disconnecting the couplings, this should not be a problem. The 4 Ton Dual, 5 Ton Dual, 6 Ton, 8 Ton and 10 Ton units have 2 circuits (with 2 suction line couplings and 2 liquid line couplings). The 12 Ton and 15 Ton units have 3 circuits (with 3 suction line couplings and 3 liquid line couplings). Half couplings may be removed to make brazing to the interconnecting tubing more convenient.

! CAUTION: When brazing tubing to the self-sealing couplings, be sure to use a wet rag, running water bath or chill blocks on the quick-connects to prevent overheating the valves and damaging the seals.

! NOTE: The interconnect tubing kit (Figure 14) contains a sufficient number of Schrader access valves to permit you to install one in each end of both the liquid and suction lines of the field-supplied tubing. Each interconnecting line (suction, liquid, hot gas) must have one of the supplied Schrader access fittings installed into the field supplied tubing. However, for short lengths of tubing, only one Schrader in each line is necessary.

4. Install the Schrader valve fittings into the tubing before brazing the couplings onto the ends of the tubing. Use a 1/4" hole to mount the valve. Clean and debur the tubing before doing any brazing to ensure that no chips or debris are left in the refrigerant circuit. Remove the Schrader valve cap and core before doing any brazing.
5. After brazing the tubing to the self-sealing coupling halves, evacuate each line to 500 microns. Check to make sure that each line holds a vacuum after removal of the vacuum pump (indicating no leaks). Add the appropriate charge of R-22 Refrigerant using the Schrader valves. Refasten male halves to outer back panel of evaporator section with flanges and screws (if they were removed for brazing to tubing). Wipe off coupling seals and threaded surfaces with a clean cloth to prevent the inclusion of dirt or foreign material into the system (See Figure 13). Lubricate rubber seal (Item ⑭) and metal seal (Item ⑮) in the male halves (Item ⑤) with refrigeration oil. Thread coupling halves together by hand to insure proper mating of threads. Continue to hand-thread each half-coupling to its mating half until resistance is felt (approximately 1-1/2 to 1-3/4 turns). Complete the connection of the mating half-couplings with a wrench. The suction line couplings (size-12) will be totally engaged after an additional 5-1/2 to 5-3/4 turns. The liquid line couplings (size-8) will

be totally engaged after an additional 4-1/2 to 4-3/4 turns.

6. Refrigerant piping shall be insulated in accordance with local codes and / or applicable ASHRAE Standards. Insulation exposed to weather shall be suitable for outdoor use. Provide protection from water and shielding from solar radiation as necessary.
7. Add R-22 refrigerant to the system to compensate for the additional interconnecting tubing as follows:

   a. For 3/8" liquid line – add 0.6 oz. per foot

   b. For 1/2" liquid line – add 1.2 oz. per foot

   c. For 5/8" liquid line – add 1.8 oz. per foot

   The suction line should be pitched downward to the compressor, sloping approximately 1/4" every ten feet to facilitate oil return.

   "P" traps (field supplied) are required for all suction line risers every 15 feet. When the evaporator is above the condensing section, an inverted "P" trap should be incorporated as close as possible to the evaporator (this minimizes floodback/oil slugging during the off cycle). If the condensing section is more than 40 feet above the evaporator, consult the factory for specific refrigeration components.

PACKAGE UNIT

If the unit is to be installed as an integral (close-coupled) unit, low voltage (thermostat) wiring is to be brought through connection Ⓐ , Figures 5 and 7, and power wiring will be brought through connection Ⓓ, Figures 5 and 7. See unit specification plate (Item ㉓, Figure 7) for power wiring minimum circuit ampacity and maximum fuse size.

SPLIT SYSTEM

If the unit is split (condensing unit remote from evaporator), the thermostat wiring is to brought through connection Ⓐ, Figures 5 and 7. Power wiring for the condensing unit is to be brought through connection Ⓓ, and the power wiring for the evaporator through connection Ⓑ. Interconnecting low voltage wiring will be brought through Ⓐ and Ⓒ to replace those discarded when separating the unit.

Power wiring to the condensing and evaporator units must be wired through circuit breakers or service disconnects. Minimum circuit ampacity and maximum fuse sizes for the condenser unit are shown on the condenser unit specification plate. Refer to specification plate (Item ㉓, Figure 7) for evaporator minimum circuit ampacity and maximum fuse size per the National Electric Code.

DUCT CONNECTION

It is recommended to use a flex collar or other means to isolate any unit vibration from being transmitted to the duct or structure.

Ductwork and plenums shall be insulated in accordance with applicable ASHRAE standards or local codes.

PRESSURE SWITCHES

High Pressure
This switch shuts the unit down in the event of excessive high pressure in the discharge line.

Low Pressure
This switch shuts the unit down in the event of excessive low pressure in the suction line.

NOTE: Pressure switches are connected to lock out relays. If the unit goes off on high or low pressure, the lock-out relays must be reset by switching the thermostat to the "OFF" position and then back to the "COOL" position. Not on Marvel Systems.

NOTE: Microprocessor controlled units do not incorporate a lock out relay. After resolving the high or low pressure situation reset the microprocessor as required. Consult seperate manual for microprocessor control.

WATER-COOLED CONDENSING UNITS

Water-Cooled Condenser
The condenser is a tube-in-tube, chemically-cleanable configuration. The inner tube carries the water and the outer tube the refrigerant.

Figure 16: Water Regulating Valve

Water Regulating Valve
Each system is equipped with a factory installed water regulating valve. This valve is pressure operated; it opens the circuit only when water is needed. The valves are set to open at 235 PSI head pressure. If it becomes necessary to change the factory adjustment, use a wrench to turn the adjusting screw on top of the spring housing. Counter-clockwise increases pressure, clockwise decreases. See Figure 16. Water source heat pumps incorporate a bypass circuit around the water regulating valve. This circuit is used in the heat mode.

Water Piping and Connections
Do not reduce the unit pipe sizes from the factory connections on the unit. Both the water inlet and outlet of the condensing package should be equipped with hand valves. This is needed for shutdown of water supply during long periods of unit shutdown and/or condenser removal, if required.

The condensate drain line should not be connected to the condenser outlet, as flooding is likely to occur. Provisions should be made for ease of piping cleaning by using plugged tees at all turns, rather than ordinary elbows.

Hook Up
Each system requires 3 gallons of water per ton per minute. Braze in your pipe water lines to the water valve(s). For future reference when cleaning is needed, record details on temperatures entering and leaving the heat exchanger and the pressure drop as a new installation. See "Cleaning The Water Cooled Condenser" on page 16.

Water Connection
Install and connect a fresh water strainer (not supplied) to the water in supply. Strainer should be readily accessible for periodic cleaning. Shut-off valves on both strainer inlet and outlet are recommended to facilitate cleaning.

CAUTION: High Temperature Fresh Water – unusually high water temperature (above 95°F) or marginal water pressure at the condenser water inlet may result in nuisance tripping of the high pressure switch.

WARNING: Water cooled units are for use with fresh water application only. Do not use for brackish water or salt water unless appropriate condenser has been installed as an option.

NOTE: On water source heat pumps, a crankcase pressure regulating valve is incorporated into the refrigerant circuit. This is to help protect the compressor should the incoming water temperature be too high.

CONDENSATE DRAIN CONNECTION

Units are equipped with two 3/4" IPS drains; one for the evaporator condensate (Item ⑯ , Figure 6); one for the condensing section (Item ⑰, Figure 6). All units require evaporator section drains to be installed. Heat pumps and water cooled condensing units also always require the installation of a condensing section drain. Units with air cooled condensers need a condensing section drain when units are installed in areas which may permit rain to enter. It is **EXTREMELY IMPORTANT** that the lines attached to these connections contain a **trap**, to ensure positive draining. It is highly recommended that the trap be primed with water prior to start-up.

The drain lines **must** be trapped because the coils are located on the negative sides of the blowers. The purpose of the condensate trap is to neutralize the negative pressure created within the cabinet by the blower.

This negative pressure can vary from less than 1" up to 2" column. The condensate trap must be of sufficient depth in water column to permit the condensate to flow from the drain pan (See Figure 17). The "A" dimension must equal or exceed the negative static pressure developed by the supply air blower. If it does not, the condensate will not drain properly and may overflow the drain pan. The trap must be at least 2-1/2" deep to maintain a water seal under all operating conditions, especially during blower start-up. When evaporator section was installed, it should have been tilted 0.375" to 0.5" down on the condensate drain side. Check to be sure this was done. See Figure 10.

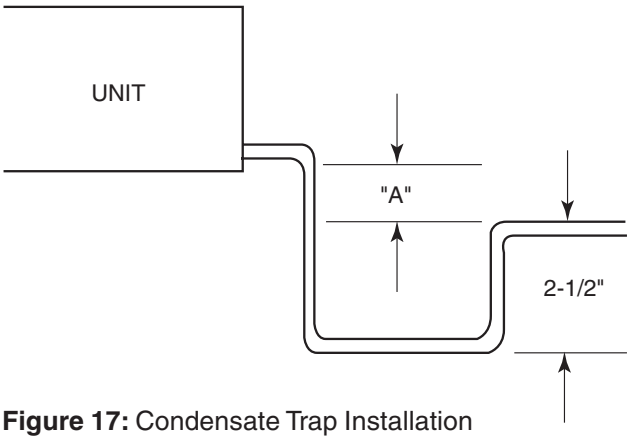


Figure 17: Condensate Trap Installation

MAINTENANCE PROCEDURES

FILTERS

Do NOT run unit without filters.

Throw-away filters are supplied with units of 2 Ton and over, and are an Underwriters Laboratories Class 2 pleated extended surface type. Filters should be checked monthly for dirt accumulation and changed when necessary. Replacement filters must be the same type as originally supplied. Units under 2 Ton are supplied with permanent filters. They should be checked monthly for dirt accumulation and cleaned when necessary.

Field access is attained by removing the cover located on the side of the left front corner of the evaporator section (Item ⑳, Figure 6). In some situations, an external filter box will be incorporated or included in the mixing box.

Figure 18: Filter Sizes And Types

UNIT	FILTER SIZE/TYPE	QUANTITY
1 to 1-1/2 Ton	17-1/2 x 13-1/2 x 1 Permanent	1
2 to 5 Ton, Single	20 x 24 x 2 Throw-Away	1
4 to 8 Ton Dual	16 x 24 x2 Throw-Away	2
10 to 15 Ton Triple	20 x 25 x 2 Throw-Away	2

NOTE: Unit must be shut off at the disconnect switch before the filters are serviced. Be sure to check that the air flow direction arrows on the filters point in the right direction.

CLEANING THE WATER-COOLED CONDENSER

Cleaning a water cooled condenser helps to improve the heat transfer rate, reduce operational cost, restore efficiency, prolong heat exchanger life, and reduce pressure drop pumping cost. Deposits from water or water treatments, such as scale, lime, rust, or mud are removed.

Each installation is unique. Therefore, the fluid quality and operating conditions will dictate when the heat exchanger needs to be cleaned.

For future reference, it may be beneficial during the startup to record the water pressure drop across as well as the inlet and outlet water temperatures of the water condenser. After a period of time these values can be checked to see how much loss of operating performance has occurred. If a 10% or greater change has occurred it would be beneficial to clean the heat exchanger.

A 5% solution of Phosphoric Acid or Oxalic Acid

can be considered for cleaning. However, there are several other commercially available environmentally safe products on the market that will do an excellent job. Contact your local wholesaler for availability. Follow all safety guidelines published by the cleaner manufacturer.

There is a safety concern whenever using any chemical cleaner at elevated temperatures. The cleaner manufacturers recommend using the cleaners at 120°F or lower. Since the heat exchanger might be in operation just prior to the cleaning, it should be cooled to lower than the 120°F threshold. Due to the ability of the heat exchangers mass to hold heat, this may take a period of time. If possible, circulate cool water through the unit to help dissipate some of the heat.

Check each field installed component to ensure the chemical cleaner will not damage them when the cleaner is circulated. For example, the structural makeup of the strainer may not stand up to the chemical detergent and rapidly deteriorate or fail to function after cleaning. If there is a possibility of this happening, use an alternative cleaner that all components will withstand or create another method of circulating the cleaner that would isolate the component in question from the cleaner. While cleaning the heat exchanger, it may also be a good idea to check and clean the strainer as well.

NOTE: Do not chemically clean a refrigerant circuit.

1. Record performance values (Ref. following charts). Turn off the fluid source.
2. Cool the heat exchanger, if above 120°F.
3. Close the valves to and from the fluid circuit loop.
4. Open the drain valve and drain all fluid from the heat exchanger.
5. Back flush the heat exchanger to remove any loose particles.
6. Attach pump and hoses as illustrated below, making sure all fittings and connections are secure.
7. Check all valving to make sure valves to system are closed and valves for cleaning loop are open.
8. Calculate the total gallons volume of the heat exchanger and the piping using the following charts:

NOMINAL PIPE SIZE	STD. STEEL PIPE VOLUME GAL./FT.	TYPE L COPPER TUBE VOLUME GAL./FT.
1/2"	.0157	.0121
5/8"	—	.0181
3/4"	.0277	.0251
1"	.0449	.0429
1-1/4"	.0779	.0653
1-1/2"	.1060	.0924
2"	.1740	.1610
2-1/2"	.2490	.2480

UNIT . . . . . _____ Gallons

Pipe (")_____ Gallons/ft x _____ ft =_____ Gallons

Pipe (")_____ Gallons/ft x _____ ft =_____ Gallons

Pipe (")_____ Gallons/ft x _____ ft =_____ Gallons

TOTAL = _____ Gallons

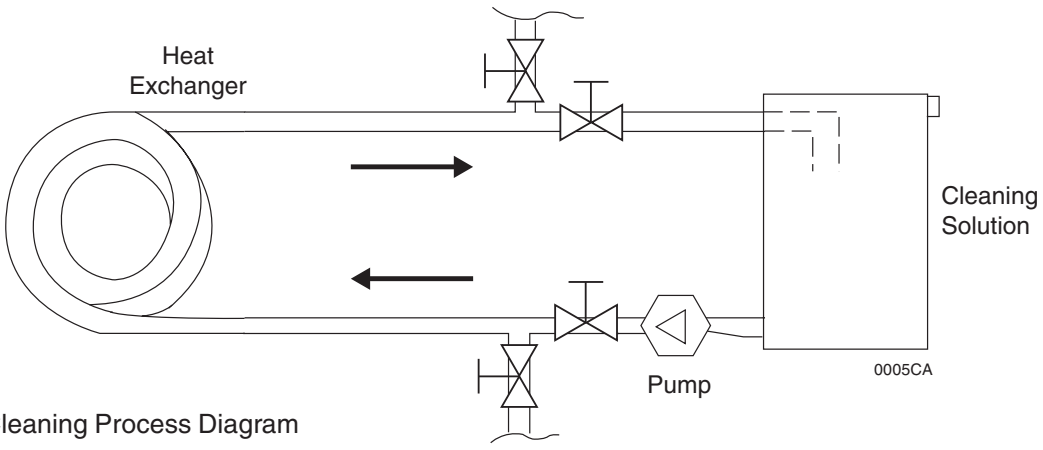


Figure 19: Cleaning Process Diagram

9. Calculate the volume of de-scaler required:

Water Quantity = 1/2 Total Gallons =____ Gallons
De-Scaler Quantity = 1/2 Total Gallons =____ Gallons

10. Make sure pump is primed.
11. Circulate the required quantity until fluid characteristics indicate that de-scaling process is complete. Manufacturer's instructions will provide details on this.
12. Disconnect pump, hoses and tank from heat exchanger.
13. Flush heat exchanger with water.
14. Return heat exchanger and system components to service. Check all valves and fitting connections.
15. Record performance values:

	BEFORE	AFTER
Pressure Drop	_____ psig	_____ psig
Entering Temp.	_____°F	_____°F
Leaving Temp.	_____°F	_____°F

BLOWERS

Air-cooled units are provided with adjustable belt drive blower packages for both the evaporator and condensing sections. Check that the blower wheel is tight on the shaft and does not contact the housing. Bearings are permanently sealed, but should be checked periodically for signs of wear. Check for restrictions or foreign material in the air circuit.

The drive may be adjusted for different static pressures. If such an adjustment is made, check that the motor current draw does not exceed the motor nameplate current by more than 10%.

Figure 20: Fan Capacities

UNIT	EVAPORATOR CFM	CONDENSER CFM
1 Ton	400	700
1-1/2 Ton	600	850
2 Ton	800	1600
3 Ton	1200	2000
4 Ton	1600	2500
5 Ton	2000	3300
6 Ton	2400	3800
8 Ton	3200	4250
10 Ton	4000	6000
12 Ton	4800	6000
15 Ton	6000	7500

On units with three-phase fan motors, check for proper blower rotation at start-up. If they run backwards, interchange two of the incoming power leads.

BLOWER MOTORS

All blower motors are equipped with thermal overload protectors.

CAUTION: Open disconnects to unit, as motor will start when automatic thermal overload resets.

BLOWER SPEED ADJUSTMENT

Blower speed may be changed by adjusting the variable diameter sheave provided on the blower drive motor. Sheave may be adjusted by removing the belt and loosening the setscrew located in the hub of the outer flange. With the setscrew loosened, the flange may be turned clockwise to increase blower speed and counter-clockwise to reduce blower speed.

CAUTION: Setscrew must be positioned directly above a flat section of the threaded sheave shaft before tightening to hold adjustment.

CAUTION: Reduction of airflow through excessive external air friction losses, lowered blower speed operation with dirty filters, or obstructed air flow may result in excessive condensation at air outlets, short cycling, or total unit shutdown due to evaporator coil icing.

NOTE: Verify that the motor current draw does not exceed the motor nameplate current by more than 10%.

BLOWER MOTOR LUBRICATION

Motor manufacturers indicate that motors never need relubrication, but if units run continuously, it is recommend that they be re-lubricated every 5500 hours (7-8 months). If unit motors are run in a cyclical manner, lubrication is recommended every 5 years.

If the unit has been inactive or in storage for over a year, relubricate before starting.

Use Chevron SRI #2 lubricant or equivalent in the following quantities: 0.6 cu. in. or 2 teaspoons, approximately 1 1/2 to 2 handle pumps using a standard grease gun. Keep grease clean, and do not mix dissimilar greases.

Clean area around fitting. Remove purge plug (only on larger motors) for greasing, and replace after at least 20 minutes of operation after greasing. For safety, we recommend relubricating while the motor is stopped.

Overgreasing, either in quantity or speed of injection, can cause premature bearing failure. Apply the recommended quantity of grease gradually while rotating the motor shaft as the grease is being applied.

BELTS

Drive belts should be examined periodically for wear and for correct tension. Belts that are too tight cause bearing wear while belts that are too loose cause slippage. If the midpoint (midway between the blower and motor shaft) of the belt is pressed inward, there should be about 1/2" to a 1" of deflection when the belt is properly tensioned. Belt tension can be adjusted by means of the adjusting bolt, which requires loosening of a nut to move the motor and change belt position.

REFRIGERANT SYSTEMS

All United CoolAir systems contain a liquid line sightglass. (See Item ⑩, Figure 8.) If bubbles appear in the sightglass, the system is either undercharged with refrigerant or there may be a restriction in the liquid line upstream of the sightglass. However, bubbles will appear every now and then in units with the hot gas bypass option. Bubbles will also appear upon compressor start up but normally clear to pure liquid after a few minutes of operation.

The sightglass contains a moisture indicator which changes color when moisture is present in the system. This indicator is the circular dot in the center of the sight glass. If the color of this indicator is green, the refrigerant is normal. When the indicator is yellow, an abnormal condition exists such as moisture within the refrigerant circuit. If an abnormal appearance exists, servicing is required. See Figure 21 for unit charges.

! NOTE: After installation and during equipment startup, the sightglass will appear yellow. This occurs during prolonged periods of non-operation and should turn green after several hours of operation.

EVAPORATOR AND AIR-COOLED CONDENSER COILS

Check semi-monthly the condition of the face of both the evaporator and condenser coils.

A dirty condenser coil will cause high condensing pressures, resulting in higher power consumption and possibly system shut-down by high-pressure safety control. A dirty evaporator coil will reduce unit capacity and eventually will cause shut-down by the low pressure safety control.

MINIMUM SERVICE ACCESS

All Service and Maintenance access is through both sides of the unit. 18" is required for the 1 and 1-1/2 ton units, 26" for all larger units.

APPLICATION DATA

	208 / 230	460
Voltage Variation	187 / 253	414 / 504

Cooling (Air Over Evap.)	**DB (Min./Max.)**	45 / 120
	WB (Min./Max.)	57 / 72

Heat Pump (Air Over ID Coil)	**DB (Min./Max.)**	50 / 80

Water-Cooled	**GPM/Ton (Min./Max.)**	2.5 / 3.5
	Leaving Water Temp. (Min./Max.)	60 / 115

HARD START KIT

A start assist device is utilized on all single-phase units. The purpose of this device is to assist the compressor in starting under low voltage conditions.

A capacitor in conjunction with a Positive Temperature Coefficient (PTC) relay is installed across the run and start windings of the motor. The PTC device utilizes a ceramic element with a predictable thermal response to the introduction of electric current. When the compressor is called upon to start, the start capacitor provides a voltage boost to the start winding of the motor and causes the motor to turn. As the starting current is introduced across the start windings, the PTC element begins to warm. When the PTC device reaches approximately 250°F (corresponding to 0.6-0.8 seconds), the resistance in the element increases and creates an open switch that releases the start winding from the circuit and the motor continues to run. If the compressor does not start before the device heats to 250°F, it will not start until the PTC device cycles through a cool-down period (usually 2-3 minutes). A compressor off-cycle timer is included in the electrical circuit for this purpose.

! The installer should verify that this timer is set for 3 or more minutes.

PHYSICAL DATA

Figure 21: Physical Data

		TONS					
		1	**1-1/2**	**2**	**3**	**4**	**5**
Voltage (d)		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
		208/230-3-60	208/230-3-60	208/230-3-60	208/230-3-60	208/230-3-60	208/230-3-60
		460-3-60	460-3-60	460-3-60	460-3-60	460-3-60	460-3-60
Supply Air (a)	CFM	400	600	800	1200	1600	2000
	ESP	.2 to 1"	.2 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"
Evap. Blower	Size	7 x 7	7 x 7	12 x 9	12 x 9	12 x 9	12 x 9
	HP	1/2	1/2	1/2	3/4	1	1
	Qty	1	1	1	1	1	1
Evaporator Coil	Rows Deep	3	3	2	2	4	4
	Face Area	1.5	1.5	3.1	3.1	3.1	3.1
Filter	Size	13-1/2 x 17-1/2 x 1	13-1/2 x 17-1/2 x 1	20 x 24 x 2	20 x 24 x 2	20 x 24 x 2	20 x 24 x 2
	Qty	1	1	1	1	1	1
Condenser Air (a)	CFM	700	850	1600	2000	2500	3300
	Max. ESP	.2 to 1"	.2 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"
Cond. Blower	Size	7 x 7	7 x 7	12 x 9	12 x 9	12 x 9	12 x 9
	HP	1/2	1/2	3/4	1	1-1/2	2
	Qty	1	1	1	1	1	1
Condenser Coil	Rows Deep	3	3	3	3	4	4
	Face Area	2.6	2.6	4.4	4.4	4.4	4.4
Water-Cooled Cond.	Pressure Drop (b)	3.7	9.42	7	6.4	8.76	10.2
	GPM	3	4.5	6	9	12	15
	Int. Volume (Water, Gallons)	0.1	0.1	0.2	0.3	0.4	0.7
Compressor	Qty	1	1	1	1	1	1
Charge R-22	Water-Cooled	2 - 0	2 - 0	2 - 8	3 - 0	4 - 12	5 - 0
(Lbs-Ozs) (c)	Air-Cooled	2 - 8	2 - 8	4 - 5	4 - 5	5 - 8	5 - 8
	Heat Pump	2 - 11	2 - 11	4 - 8	4 - 8	5 - 11	5 - 11
Weight (Net Operating)	Water-Cooled	310	310	540	545	600	605
	Air-Cooled	375	375	600	610	660	665
	Chilled Water	125	125	200	210	220	220
	Heat Pump	400	400	625	635	690	695

(a) Air flow performance may require other than standard drive components.

(b) Does not include water regulating valve.

(c) Split units need additional refrigerant. Refer to note 7, page 14.

(d) 277-1-60 supply voltage requires use of Buck/Boost Transformer. Refer to page 28.

All specifications subject to change without notice.

PHYSICAL DATA

Figure 21: Physical Data (continued)

		TONS						
		4	**5**	**6**	**8**	**10**	**12**	**15**
Voltage (d)		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	- - -	- - -	- - -
		208/230-3-60	208/230-3-60	208/230-3-60	208/230-3-60	208/230-3-60		
		460-3-60	460-3-60	460-3-60	460-3-60	460-3-60	460-3-60	460-3-60
Supply Air (a)	CFM	1600	2000	2400	3200	4000	4800	6000
	ESP	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"
Evap. Blower	Size	12 x 9	12 x 9	12 x 9	12 x 9	15 x 9	15 x 9	15 x 9
	HP	1	1	2	3	3	5	7.5
	Qty	1	1	1	1	1	1	1
Evaporator Coil	Rows Deep	3	3	3	3	3	4	4
	Face Area	5.2	5.2	5.2	5.2	6.8	6.8	6.8
Filter	Size	16 x 24 x 2	16 x 24 x 2	16 x 24 x 2	20 x 25 x 2	20 x 25 x 2	20 x 25 x 2	20 x 25 x 2
	Qty	2	2	2	2	2	2	2
Condenser Air (a)	CFM	2500	3300	3800	4250	6000	6000	7500
	Max. ESP	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"
Cond. Blower	Size	15 x 9	15 x 9	15 x 9	15 x 9	15 x 15	15 x 15	15 x 15
	HP	1-1/2	2	2	3	5	5	7.5
	Qty	1	1	1	1	1	1	1
Condenser Coil	Rows Deep	6	6	6	6	8	8	8
	Face Area	6.4	6.4	6.4	6.4	7.3	7.3	7.3
Water-Cooled Cond.	Pressure Drop (b)	7	8.1	6.4	8.8	10.2	8.8	10.2
	GPM	12	15	18	24	30	36	45
	Int. Volume (Water, Gallons)	.2 ea	.2 ea	.3 ea	.4 ea	.7 ea	.4 ea	.7 ea
Compressor	Qty	2	2	2	2	2	3	3
Charge R-22	Water-Cooled	2 - 14 ea	3 - 4 ea	3 - 14 ea	4 - 0 ea	5 - 0 ea	4 - 0 ea	5 - 0 ea
(Lbs-Ozs) (c)	Air-Cooled	4 - 8 ea	4 - 14 ea	5 ea	4 - 8 ea	6 - 10 ea	5 - 8 ea	6 ea
	Heat Pump	4 - 11 ea	5 - 1 ea	5 - 3 ea	4 - 11 ea	6 - 13 ea	5 - 11 ea	6 - 3 ea
Weight (Net Operating)	Water-Cooled	865	870	880	895	966	1071	1092
	Air-Cooled	910	915	930	945	1100	1215	1225
	Chilled Water	——	——	290	300	340	360	370
	Heat Pump	960	965	980	995	1150	1290	1300

(a) Air flow performance may require other than standard drive components.

(b) Does not include water regulating valve.

(c) Split units need additional refrigerant. Refer to note 7, page 14.

(d) 277-1-60 supply voltage requires use of Buck/Boost Transformer. Refer to page 28.

All specifications subject to change without notice.

SEQUENCE OF OPERATION

COOLING SEQUENCE OF OPERATION

1. Before starting the unit, make sure electrical power has been turned on for a minimum of 24 hours. This assures that any liquid refrigerant is "driven" out of the crankcase.
2. For water-cooled units, make sure condenser water is available. Open all stop valves. Verify that cooling tower is functioning, if this is the source of condensing water supply. Start circulating the water to the water condenser.
3. The following sequence is based on the unit being controlled by a room thermostat. If another control type is being utilized, reference the instructions for that device may be required.
   a. Raise thermostat setpoint to highest level.
   b. Set System switch to "OFF" position.
   c. Set Fan switch to the "AUTO" position.
   d. Moving the Fan switch to the "ON" position should cause the evaporator blower motor to run. Moving the Fan Switch back to "AUTO" should stop the blower.
   e. Move the System switch to the "COOL" position. Slowly lower the thermostat setting to call for cooling. The evaporator blower should start (assuming the Fan switch is set to "AUTO") and the System No. 1 compressor should start.
   f. On those units with multiple compressors, if the thermostat setpoint continues to be lowered, the second compressor should then start.
   g. Set room thermostat at desired space temperature and the Fan switch to "AUTO" or "ON". The unit will cycle as required to maintain conditions.
4. Chilled water sequence is the same as above, except compressor activation is replaced by the chilled water valve function.
5. Heat pump cooling sequence is the same as above, except the reversing valve will also be activated when the compressor cycle is started.

HEATING SEQUENCE OF OPERATION (OTHER THAN HEAT PUMP)

1. The following sequence is based on the unit being controlled by a room thermostat. If another control type is being utilized, reference the instructions for that device may be required.
   a. Lower thermostat setpoint to the lowest level.
   b. Set System switch to "OFF" position.
   c. Set Fan switch to "AUTO" position.
   d. Moving the Fan switch to the "ON" position should cause the evaporator blower motor to run. Moving the Fan switch back to "AUTO" should stop the blower.
   e. Move the System switch to the "HEAT" position. Slowly raise the thermostat setting to call for heating. The evaporator blower should start (assuming the Fan switch is set to "AUTO") and the electric heating element will be activated.
   f. On those units with a second stage of electric heat, if the thermostat setpoint continues to be raised, the second stage of electric heat should then be activated.

! NOTE: Units with more than one stage of electric heat require a two stage heat thermostat.

   g. Set room thermostat at desired space temperature and set the Fan switch to "AUTO" or "ON". The unit will cycle as required to maintain conditions.

HEAT PUMP HEATING SEQUENCE OF OPERATION

1. Before starting the unit, make sure electrical power has been turned on for a minimum of 24 hours. This assures that any liquid refrigerant is "driven" out of the crankcase.
2. For water-cooled units, make sure condenser water is available. Open all stop valves. Verify that cooling tower is functioning, if this is the source of condensing water supply. Start circulating the water to the water condenser.
3. The following sequence is based on the unit being controlled by a room thermostat. If another control type is being utilized, reference to the instructions for that device may be required.

   a. Lower thermostat setpoint to the lowest level.

   b. Set System switch to "OFF" position.

   c. Set Fan switch to "AUTO" position.

   d. Moving the Fan switch to the "ON" position should cause the evaporator blower motor to run. Moving the Fan switch back to "AUTO" should stop the blower.

   e. Move the System switch to the "HEAT" position. Slowly raise the thermostat setting to call for heating. The evaporator blower should start (assumes Fan switch set to "AUTO") and the System No. 1 compressor will start.

   f. On those units with multiple compressors, if the thermostat setpoint continues to be raised, the second compressor should then start.

   g. Set room thermostat at desired space temperature. Set the Fan switch to "AUTO" or "ON". The unit will cycle as required to maintain conditions.

OPTIONS

CONDENSATE PUMP

If extreme condensate conditions exist, it is possible to have a condensate pump installed in the evaporator drain pan without need for separate power source (See Item ㉒, Figure 6 - External Flare Connection). Raise the tubing to the highest possible point above the pump (maximum 12 feet). A 4 ft. rise delivers 50 GPH; a 10 ft. rise delivers 15 GPH. Form an inverted "U" trap as shown in Figure 22 below. This helps to prevent backward siphoning, which causes excessive pump cycling. If this configuration is not possible, the installation of a check valve (Hartell Model VCV-4) is recommended.

Operation of the condensate pump is automatic. Water is collected in the drain pan. When the internal float raises to a pre-set point, the pump will be activated. As the condensate level goes down, the float turns off the pump at another preset point.

NOTE: In case of algae formation, use a commercially available algaecide. After use of the algaecide, rinse with water. Repeat as necessary. Be careful not to clog the check valve or tubing when starting the pump.

CAUTION: Flexible tubing (1/4" I.D.) should be supported to prevent kinking and possible pump damage.

THERMOSTAT

Standard units (no heating) with one compressor require single stage thermostats, cool only. Units with two or three compressors require dual stage thermostats, cool only.

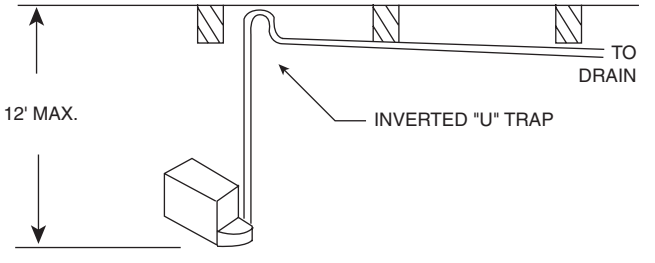


Figure 22: Condensate Pump and Trap Installation

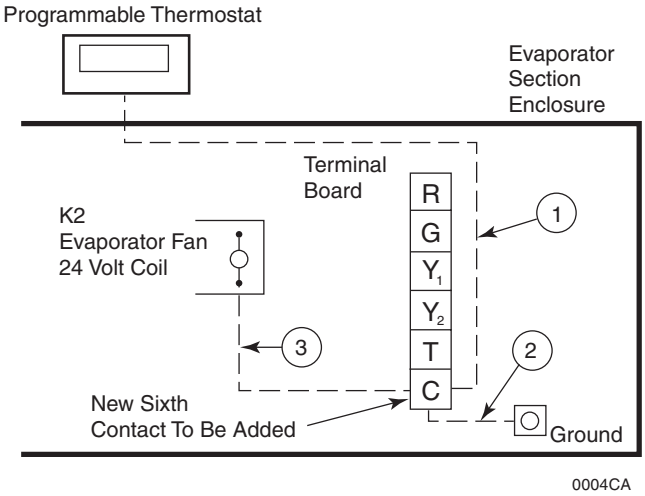


Fig 23: Adding Sixth Contact

When a programmable thermostat is used, a sixth contact must be added to the terminal board in the evaporator section. Three connections must be made from this sixth contact . . . ① to the programmable thermostat, ② to a ground and ③ to the 24 volt coil of the evaporator fan motor contactor (K2). See Figure 23.

Heat pump units and units with auxiliary electric heat (either integral in unit or in duct) require single stage, cool/heat heat pump thermostats if units have only one compressor. Units with two or three compressors require dual stage heat pump thermostats with cool/heat functions.

CHECKING HOT GAS BYPASS VALVE

1. Connect a calibrated thermocouple lead to the outlet line at the hot gas bypass valve. Tie wrap and insulate the lead.
2. Connect a low pressure refrigerant gauge to the suction line.
3. Connect a high pressure refrigerant gauge to the liquid line.
4. Operate air conditioner in the cooling mode until system is stabilized. (Approximately 15

minutes)

5. If the high side pressure is not at or above 250 psig, block off the condenser inlet air stream until the pressure is above this threshold. This will simulate a system performance level close to the design condition of 95° F ambient.
6. The hot gas bypass valve setting is 58 psig.
   a. If the suction pressure is 58 psig the thermocouple reading should be approximately 120° F or higher. Please note that it may be necessary to block off some of the evaporator air in order to check this condition.
   b. If the suction pressure is above 58 psig the thermocouple reading should be less than 120° F.
   c. If the suction pressure is below 58 psig the hot gas bypass valve should be adjusted to raise the pressure.

ADJUSTMENT OF HOT GAS BYPASS VALVE

The function of the hot gas bypass valve is to prevent the suction pressure from falling below a predetermined set point, thereby balancing the system. The set point is typically 58 psig (R-22).

Refer to the procedure for Checking the Hot Gas Bypass Valve before proceeding. This will help to establish where the valve is currently set.

1. Connect a low pressure refrigerant gauge to the suction line.
2. Operate air conditioner in the cooling mode until system is stabilized. (Approximately 15 minutes)
3. Remove the seal cap on the top of the hot gas bypass valve.
4. Adjust the valve by turning the stem. A CLOCKWISE turn will increase the pressure setting. A COUNTERCLOCKWISE turn will decrease the pressure setting. One complete turn is equal to approximately a 4 psi change.

   Adjustments should be made in small increments, allowing the system to stabilize after each turn.

5. Vary the evaporator load to test at various conditions that the suction pressure does not fall below the set point (58 psig for R-22).
6. Replace the seal cap on the top of the hot gas bypass valve.

NOTE:
a. On split system applications the hot gas bypass line to the evaporator should be insulated to prevent condensation.
b. Use a wet rag around the hot gas bypass valve when doing any brazing

MARVEL MICROPROCESSOR CONTROLLER

The microprocessor controller allows you to control up to 16 separate zones independently from one location. There are 12 critical alarm sensors per zone to monitor such things as cooling, heat, humidity; and there are optional day/night setbacks for multiple time cycles. User setpoints are easily programmed at the keypad location. For further information, refer to the Installation Instructions for the Marvel controller which accompanies the unit.

HUMIDIFIER

The optional steam humidifier that comes with the unit functions on the electrode principle. As water fills the plastic steam generator, it immerses metal electrodes which then permits electrical current flow through the water. This current flow produces heat which then boils the water into steam. This steam is then injected on the downstream side of the cooling coil to provide humidification for the area being served by the unit. Water is replenished through tubing and the 1/4" flare located on the evaporator coil panel structure. See Item ㉒, Figure 6. For further information on operation refer to the Installation Instruction for air conditioning humidifiers which accompanies the unit.

ELECTRIC HEAT

Electric heat is possible in two options. Option 1 is integrally built into the unit behind the evaporator coil, separate power supply is not required.

Option 2 is field installed in the form of a duct heater and must be installed a minimum of 4' downstream from the unit in the evaporator discharge duct. A separate power supply is required for the heat. Consult wiring diagrams on inside of control box covers, which are inside Item ⑦ and Item ⑧, Figure 5, and on the electric heater. See Figure 7, for photo details of wiring.

ELECTRIC REHEAT

On a call for dehumidification the compressor comes on and the evaporator coil removes the moisture from the air passing through it. The electric heater then reheats the air passing through it to maintain the temperature in the space that needs to be conditioned.

STEAM COIL

The steam coil is located directly behind the DX cooling coil. The coil is copper tube/aluminum fin. Connections exit the cabinet at the coil location. Standard steam coils and non-freeze steam coils are available. Controls and valves for steam coils are supplied by others.

HOT WATER COILS

The hot water coil is located directly behind the DX cooling coil. The coil is copper tube/aluminum fin. Connections exit the cabinet at the coil location. Controls and valves for hot water coils are supplied by others.

LOW AMBIENT DAMPER CONTROL

For use where the air conditioner is expected to operate with outdoor ambients below 60°F, the damper will maintain the condensing pressure at approximately 220 PSIG down to an ambient of 0°F.

The damper is installed directly onto the condenser inlet duct connection. The damper actuator cylinder must be in the upright position with the threaded connection “up”. A 1/4" copper tube is connected to the pressure operator with a flare nut. The other end of the 1/4" tube (with flare nut) is run through a grommet in the condenser panel (Item ⑱, Figure 6), to the liquid access fitting (marked “Low Ambient Damper”), located in the condensing section.

NOTE: On 4 to 15 Ton units, with dual or triple refrigerant circuits, it is EXTREMELY IMPORTANT that the 1/4" tube from the damper pressure operator be connected to the liquid line access fitting of System No. 1. Connection to System No. 2 or 3 will cause malfunction. The systems are clearly identified on the unit.

FAN CYCLING

This option controls the head pressure by cycling the condenser blower motor off and on. The effective range of use for this option is down to 40°F. A fan cycling bypass thermostat (optional) is also available. This is an adjustable thermostat that is typically set between 65°F and 70°F. This thermostat will bypass the fan cycling control above the set point to minimize rapid or quick fan cycling at moderate outdoor temperatures.

FLOODED CONDENSER

When the outdoor ambient falls, the condensing pressure falls. This causes the discharge pressure to fall as well. Since the pressure differential across the thermostatic expansion valve port affects the rate of refrigerant flow, low head pressure generally causes insufficient refrigerant to be fed to the evaporator. Failure to have sufficient head pressure will result in low suction pressure and/or iced evaporator coils. The effective range for this option is down to -30°F.

The purpose of a flooded condenser is to hold back enough of the condensed liquid refrigerant so that some of the condenser surface is rendered inactive. This reduction of active condensing surface results in a rise in condensing pressure and sufficient liquid line pressure for normal system operation.

A three-way modulating valve and a receiver make up the flooded condenser refrigerant components.

The valve is placed in the liquid line after the condenser. The receiver is downstream of the valve. The valve limits the flow of liquid refrigerant from the condenser while at the same time regulating the flow of discharge gas around the condenser to the receiver.

During periods of low ambient operation, the receiver pressure falls until it approaches the setting of the control point of the valve (typically 180 PSIG for R-22). The valve then throttles to restrict the flow of liquid from the condenser. This raises the condenser pressure. Since it is the receiver pressure that is being maintained, the valve will then start to throttle open the discharge port when the differential between the condensing pressure and the receiver pressure exceeds 20 PSI. The hot discharge gas serves to heat up the cold liquid being passed from the condenser to the receiver. Thus the liquid reaches the receiver warm and with sufficient pressure to assure proper expansion valve operation.

The receiver is required to hold all of the excess/additional liquid refrigerant in the system, since the refrigerant will be returned to the receiver when high ambient conditions exist.

In the off-cycle the refrigerant can "migrate" to the condenser, during periods of low outdoor ambient. On a call for start-up, the evaporator pressure may not build up to the cut-in point of the low pressure control. The result may be a failure of the compressor to start or to short cycle. To eliminate this potential problem, a time delay is added to bypass the low pressure switch during start-up.

BUCK/BOOST TRANSFORMER

Units being applied on a 277-1-60 power supply require the use of a buck/boost transformer. The transformer will reduce the voltage from 277-1-60 to 230-1-60. The unit is supplied with components for 230-1-60 application. Table 5 lists the buck/boost transformers available from United CoolAir. Figure 24 illustrates the wiring for each transformer.

Table 5: Buck/Boost Transformer Table

United CoolAir Part Number	LOAD		Max. Size of Fuse or Breaker
4CA1901	KVA	1.44	10A
	Amps	6.25	
4CA1902	KVA	2.88	15A
	Amps	12.5	
4CA1903	KVA	4.31	20A
	Amps	18.75	
4CA1904	KVA	5.75	30A
	Amps	25.0	
4CA1905	KVA	8.63	40A
	Amps	37.5	
4CA1906	KVA	11.5	60A
	Amps	50.0	
4CA1907	KVA	17.25	80A
	Amps	75.0	

Single-Phase

SOLENOID BYPASS FOR WATER REGULATING VALVE

On water-cooled units a N.O. solenoid valve is placed in the water supply loop. During the "off" cycle the solenoid is opened, thus allowing water to bypass the heat exchanger. The solenoid device is rated for 150 PSIG or less.

CHILLED WATER VALVES

Chilled water valves, if supplied by United CoolAir, are typically on/off only. The valve would be shipped loose for installation in the field. The valve is to be mounted in the outlet line of the coil.

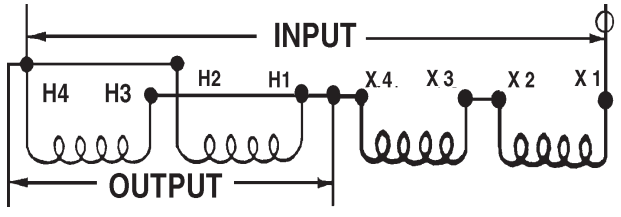


FIGURE 24: Transformer Wiring 0023CA

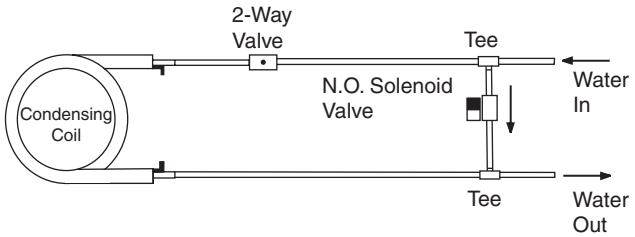


FIGURE 25: 2-Way Single Circuit With Bypass 0024CA

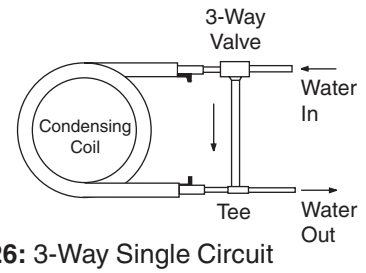


FIGURE 26: 3-Way Single Circuit

COMPRESSOR

The standard compressor is reciprocating. Scroll compressors are available in certain sizes and voltages.

THREE-WAY WATER REGULATING VALVE

Three-way water regulating valves modulate the water flow through the heat exchanger to maintain the head pressure.

HIGH PRESSURE WATER REGULATING VALVE

Water regulating valves with a pressure rating of 350 PSIG are available.

ECONOMIZER OPERATION (AIRSIDE)

The optional economizer operation utilizes outside air as much as possible for temperature and humidity control in the conditioned spaces.

To ensure that outside conditions are suitable for this, an enthalpy sensor, mounted in a position where it is continuously exposed to the ambient, decides whether a call for cooling is best answered by mechanical cooling or by a mixture of outside and re-circulated air. If the system brings in a continuous supply of some fresh air, the sensing unit can be mounted on the duct with the sensor in the air stream.

The enthalpy sensor and its associated signal conditioner measures both humidity and temperature. The combination of both determines the total heat content of the air.

When these conditions meet the setting selected on the enthalpy sensing unit, a SPDT switch is energized and a call for cooling from the first stage of the room thermostat is then directed to the damper controller, which is usually mounted in the conditioned space near the regular thermostat.

The damper controller has its own temperature sensor, which causes the unit to send a signal of variable strength to the damper motor(s), depending on the difference between the sensed temperature and the selected setting on the controller.

This signal controls the ratio of how far open the outside and re-circulated air dampers are to each other, resulting in just the right amount of outside air that must be introduced into the room to maintain the selected temperature that has been set on the damper controller.

Some accommodation must be made to exhaust excess air, brought into the conditioned spaces from outside. In the case of a full economizer installation, this can be as much as the total volume of air circulated in normal cooling operation.

When outside conditions are no longer suitable for cooling the conditioned space, the outdoor air enthalpy sensor will return control of room temperature to the regular room thermostat , which will then cycle the compressors on and off as required to maintain the set space temperature.

Refer to the system electrical control circuit diagram for proper wiring to integrate the enthalpy sensor and damper controller into the remainder of the system control circuitry.

ECONOMIZER OPERATION – (WATERSIDE)

The waterside economizer is also referred to as a “free cooling coil”.

The free cooling coil is installed after the DX cooling coil in the cabinet.

A sensor is provided in the water inlet side of the water cooled condenser. If the incoming water temperature is below the control setpoint, a normally closed solenoid valve opens and lets the water pass through the free cooling coil. The refrigerant circuit is deactivated during the free cooling economizer operation.

CONDENSING SECTION OUTDOOR MODIFICATION KIT

This kit is available to attach to the outside condenser/condensing section (See Fig. 28). The air deflector prevents condenser discharge air from recirculating into the condenser return air. The weather hood minimizes the possibility of water and snow being pulled in. The screens keep debris, wildlife and hands out of unit. See Figure 27 for various sizes.

SPLIT CONDENSER / CONDENSING SECTIONS

Condensers (without compressors) or condensing sections (with compressors) are available for split applications, both air- and water-cooled. For condensers/condensing units to be used with evaporator sections, other than United CoolAir products, the units are supplied with the refrigerant lines capped with only a holding charge of nitrogen. See Figure 29 for dimensions and piping outlet locations.

Figure 27: Condensing Section Outdoor Modification Kit Dimensions

TONS	B	C	D	Q	R	AD	BF	PIPING OUTLET LOCATIONS
12-15 TRIPLE CIRCUIT	70 5/8	29	45 5/16	72 1/16	32 1/8	11 1/8	55 9/16	ROWS 1, 2 & 3
10 DUAL CIRCUIT	70 5/8	29	45 5/16	72 1/16	32 1/8	11 1/8	55 9/16	ROWS 1 & 3
4-8 DUAL CIRCUIT	55 3/8	27	40 3/8	56 3/4	27 1/4	11 1/8	50 3/4	ROWS 1 & 2
2-5 SINGLE CIRCUIT	47 3/8	22	34 3/4	48 3/4	21 9/16	11 1/8	45 1/8	ROW 1
1-1.5 SINGLE CIRCUIT	35 15/16	16	29 9/16	37 5/16	25 1/4	2 3/16	39 15/16	

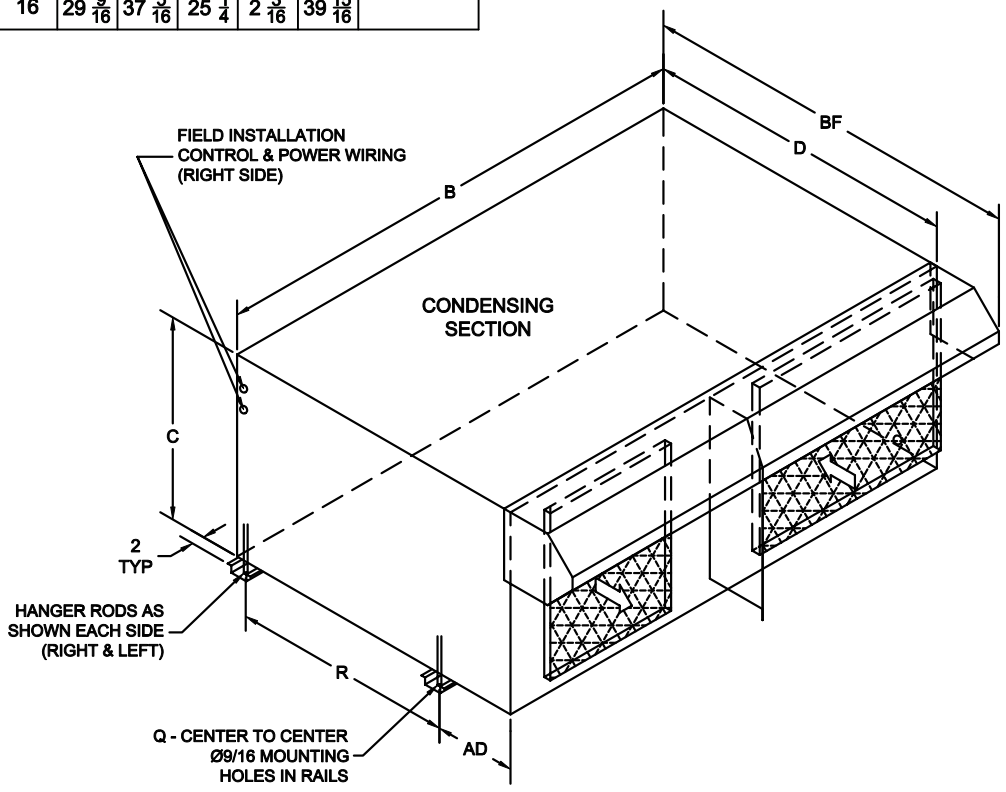
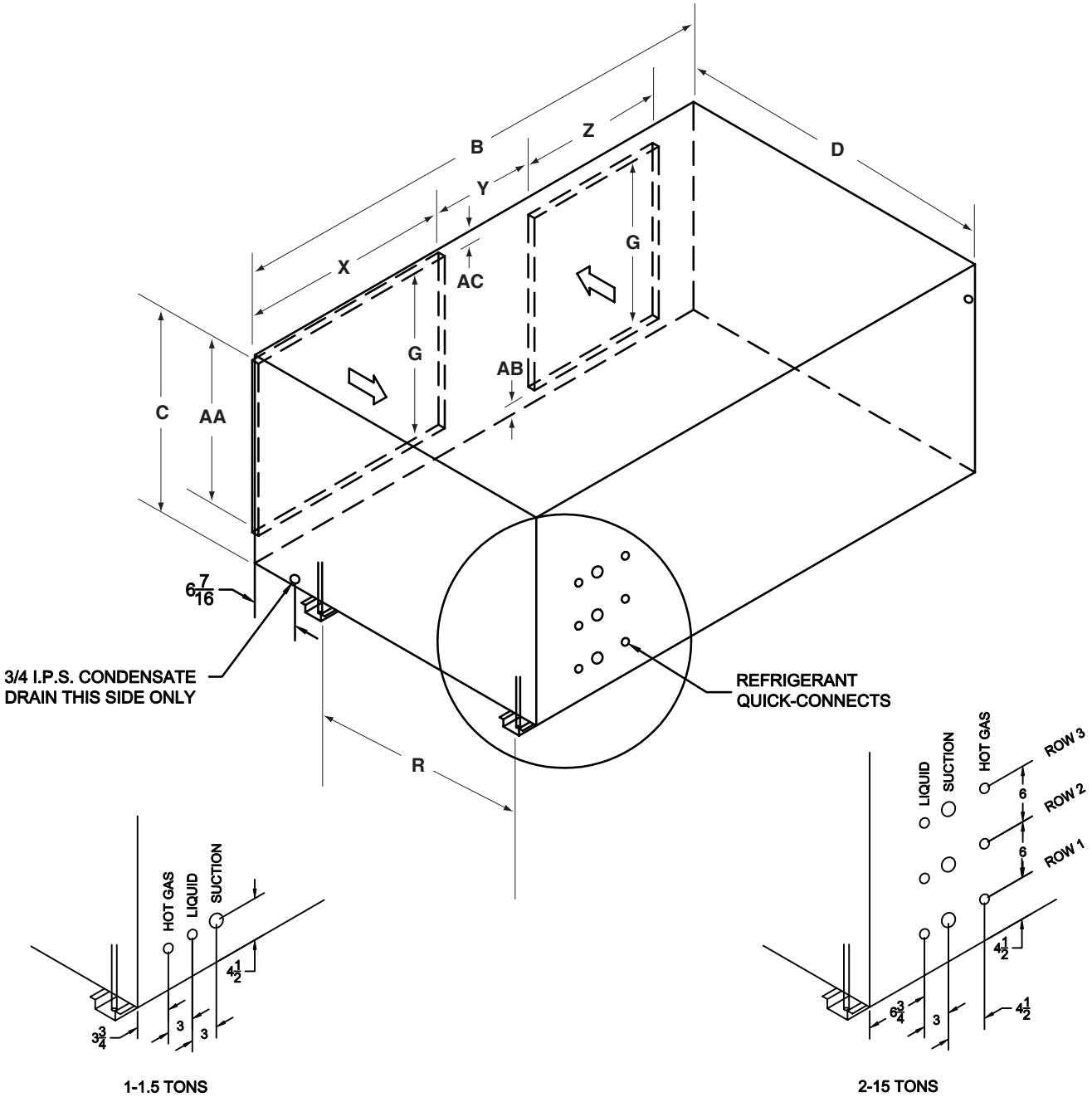


Figure 28: Condensing Section Outdoor Modification Kit (Optional)

Figure 29: Piping Outlet Locations – Split Condenser / Condensing Sections

TONS	B	C	D	Q	R	V	X	Y	Z	AA	AB	AC	AD	PIPING OUTLET LOCATIONS
12-15 TRIPLE CIRCUIT	70 5/8	29	45 5/16	72 1/16	32 1/8	5 5/8	30	14 7/16	20	24	3 1/2	1 1/2	11 1/8	ROWS 1, 2 & 3
10 DUAL CIRCUIT	70 5/8	29	45 5/16	72 1/16	32 1/8	5 5/8	30	14 7/16	20	24	3 1/2	1 1/2	11 1/8	ROWS 1 & 3
4-8 DUAL CIRCUIT	55 3/8	27	40 3/8	56 3/4	27 1/4	3 11/16	18	15 1/16	18	20	4 11/16	2 3/16	11 1/8	ROWS 1 & 2
2-5 SINGLE CIRCUIT	47 3/8	22	34 3/4	48 3/4	21 9/16	4 11/16	16	10	16	16	4 11/16	1 3/16	11 1/8	ROW 1
1-1.5 SINGLE CIRCUIT	35 15/16	16	29 9/16	37 5/16	25 1/4	4 15/16	12	6 1/4	12 1/16	12	2 3/4	1 1/4	2 3/16	



VERTICAL STACKING UNIT

The vertical stacking option is designed for installations where floor space is minimal and a ceiling space is not available. The evaporator section is placed above the condensing section for location in small spaces. Evaporator discharge air is available through the front or top for easy duct installation. **Note: For other sheet metal arrangements, contact your local sales office**.

A rigid frame system supports the evaporator and provides vibration-free operation. Quick-connect couplings allow the unit to be split in the field, if needed, for installation. The interconnecting wiring is protected by a cover.

The stacking units are available in all models. See Figures 30 through 33.

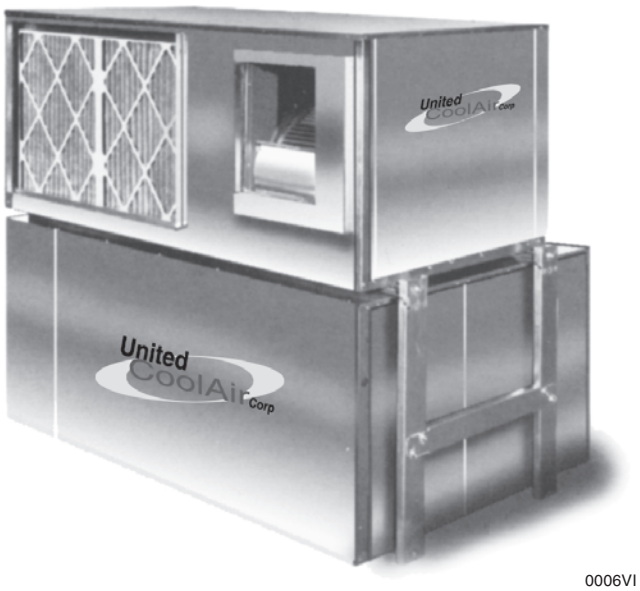
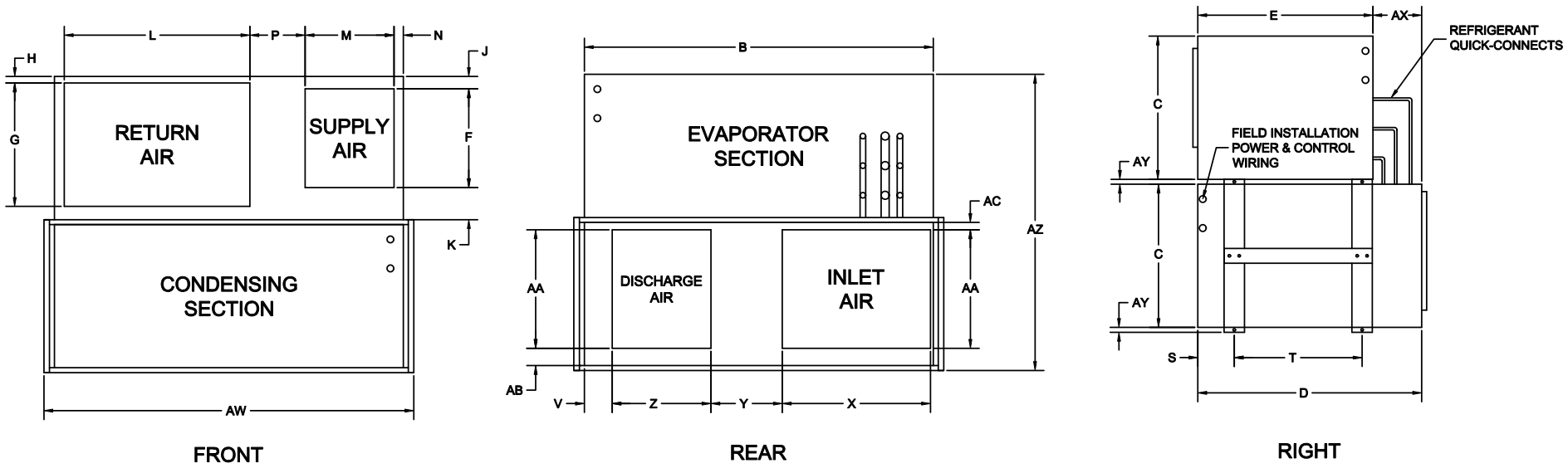


Figure 30: Vertical Stacking Unit, Front View

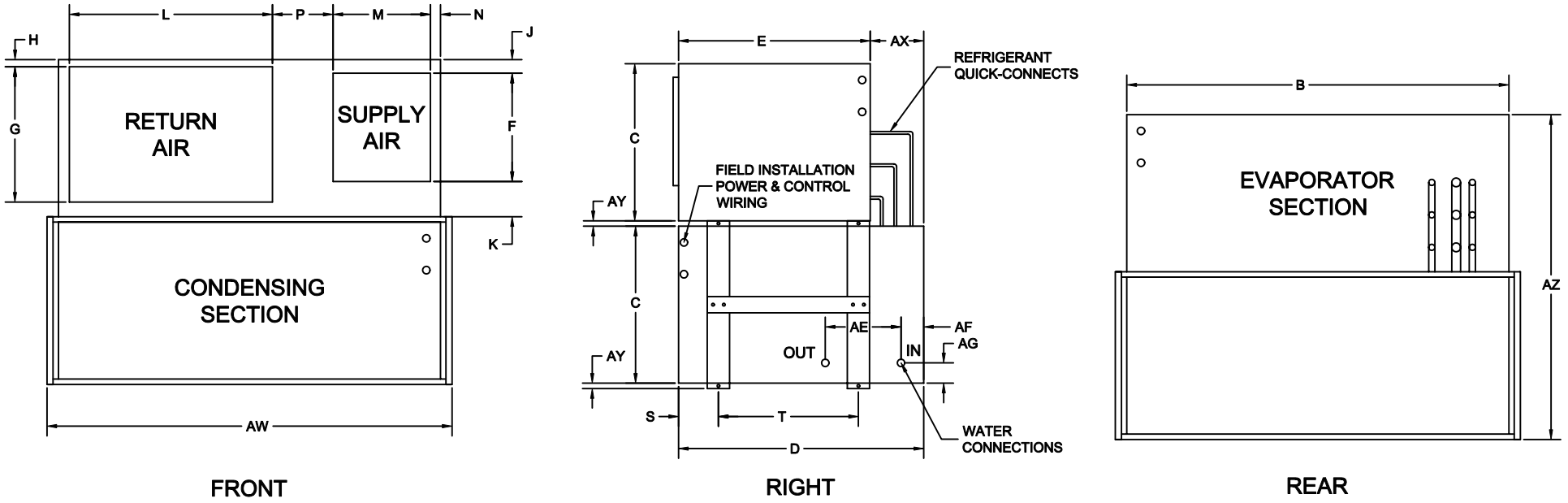
Figure 31: Vertical Stacking Unit, Rear View

Figure 32: Outline Dimensions For Air-Cooled Vertical Stacking Units



TONS	B	C	D	E	F	G	H	J	K	L	M	N	P	S	T	V	X	Y	Z	AA	AB	AC	AW	AX	AY	AZ
10-15	70 5/8	29	45 5/16	35 7/16	20	25	1 5/16	2 1/2	6 1/2	37 9/16	18	1 7/8	11 3/16	7 3/8	25 7/8	5 5/8	30	14 7/16	20	24	3 1/2	1 1/2	74 7/8	9 7/8	1 1/8	60 1/4
4-8	55 3/8	27	40 3/8	35 7/16	18	23	1 5/16	3 5/8	5 3/8	32	16	3	2 5/16	7 5/16	21 1/16	3 11/16	18	15 1/16	18	20	4 11/16	2 3/16	59 5/8	4 15/16	1 1/8	56 1/4
2-5	47 3/8	22	34 3/4	31 9/16	16	18	1 5/16	3/4	5 1/4	24	16	3	2 5/16	7 3/8	22 1/16	4 11/16	16	10	16	16	4 11/16	1 3/16	51 5/8	3 3/16	1 1/8	46 1/4
1-1.5	35 15/16	16	29 9/16	22 1/16	12	12	1 5/16	1	3	16 1/8	12	4 1/16	2 5/16	4 3/4	15 1/4	4 15/16	12	6 1/4	12 1/16	12	2 3/4	1 1/4	40 3/16	7 1/2	1 1/8	34 1/4

Figure 33: Outline Dimensions For Water-Cooled Vertical Stacking Units



TONS	B	C	D	E	F	G	H	J	K	L	M	N	P	S	T	AE	AF	AG	AW	AX	AY	AZ	WATER PIPING IN & OUT SIZE
12-15 TRIPLE CIRCUIT	70 5/8	29	45 5/16	35 7/16	20	25	1 5/16	2 1/2	6 1/2	37 9/16	18	1 7/8	11 3/16	7 3/8	25 7/8	14	4 3/16	3 3/4	74 7/8	9 7/8	1 1/8	60 1/4	Ø1 3/8
10 DUAL CIRCUIT	70 5/8	29	45 5/16	35 7/16	20	25	1 5/16	2 1/2	6 1/2	37 9/16	18	1 7/8	11 3/16	7 3/8	25 7/8	14	4 3/16	3 3/4	74 7/8	9 7/8	1 1/8	60 1/4	Ø1 3/8
4-8 DUAL CIRCUIT	55 3/8	27	40 3/8	35 7/16	18	23	1 5/16	3 5/8	5 3/8	32	16	3	2 5/16	7 5/16	21 1/16	13	4 1/2	3 3/4	59 5/8	4 15/16	1 1/8	56 1/4	Ø1 1/8
5 SINGLE CIRCUIT	47 3/8	22	34 3/4	31 9/16	16	18	1 5/16	3/4	5 1/4	24	16	3	2 5/16	7 3/8	22 1/16	13	3 3/4	3 3/4	51 5/8	3 3/16	1 1/8	46 1/4	Ø1 1/8
2-4 SINGLE CIRCUIT	47 3/8	22	34 3/4	31 9/16	16	18	1 5/16	3/4	5 1/4	24	16	3	2 5/16	7 3/8	22 1/16	13	3 3/4	3 3/4	51 5/8	3 3/16	1 1/8	46 1/4	Ø 7/8
1-1.5 SINGLE CIRCUIT	35 15/16	16	29 9/16	22 1/16	12	12	1 5/16	1	3	16 1/8	12	4 1/16	2 5/16	4 3/4	15 1/4	5	5	3 1/16	40 3/16	7 1/2	1 1/8	34 1/4	Ø 7/8

TROUBLESHOOTING

WARNING: Turn OFF power to unit before conducting any troubleshooting, unless the tests you are performing require system operation. Keep hands, clothing and tools clear of electrical terminals and rotating components.

ITEM CODE	PROBLEM	PROBABLE CAUSE	SOLUTION
1	Control is erratic.	Wired improperly or connections are broken	Check wiring connections against schematic diagram.
2	Blower fails to start.	Defective contactor	Repair or replace contactor.
		Overload tripped	Reset and check cause.
		Marvel alarm	Clear alarm(s) after correcting problem.
3	Compressor fails to start.	Thermostat set too high	Adjust to desired temperature.
		Complete loss of refrigerant charge	Repair leak and recharge refrigerant system.
		Head pressure too high (high pressure switch open)	Check condenser for obstructions and remove. Check for the required water flow through the water regulating valve and the condenser coil. Manually reset thermostat. With Marvel, turn off alarm and reset.
		PTCR will keep compressor OFF for 3 - 5 minutes	Wait for PTCR to cool off. Compressor should start in 3 - 5 minutes.
4	Compressor short cycles.	Drain pan switch open	Check if the unit is draining properly.
		Low line voltage causing compressor to overheat	Check power source for cause of electric variation of line voltage.
		Dry or icy evaporator coil (reduced air flow)	Defrost and clean coil and replace dirty filters.
		Lack of refrigerant (bubbles in sight glass)	Check for leak. Repair and recharge the system.
		Short cycling of conditioned air	Make sure that duct connections are proper for return air and supply air and ensure that they do not mix with each other.

NOTE: For operating and troubleshooting instructions for Marvel Controller or humidifier, refer to specific operating instructions that accompany the unit.

– continued on page 35

ITEM CODE	PROBLEM	PROBABLE CAUSE	SOLUTION
5	Evaporator coil ices.	Lack of proper air quantity	Check filters: Clean or replace if necessary. Check for obstruction across coil. Check rotation of evaporator blower to ensure correct rotation of evaporator blowers.
		Low return air temperature	Raise return air setpoint.
		Low refrigerant	Check for leaks and repair and recharge the system.
6	Noisy compressor	Expansion valve stuck in open position (cold suction line)	Ensure feeler bulb is tight on suction line. Check operation and superheat.
		Broken compressor valve (compressor knocking)	Replace compressor.
		Worn or scarred compressor bearings	Replace compressor.
		Liquid slugging	System overcharged. Reclaim excess refrigerant from the high side of the system.
		Excessive head pressure	Reduce head pressure (see item 8 below).
7	System short of capacity	Flash gas in liquid line (bubbles in sight glass)	Check for leaks. Repair, and recharge the system.
		Expansion valve stuck open or possibly obstructed	Replace Valve.
		Clogged filter drier	Replace with new filter-drier.
		Ice or dirt on evaporator coil	Defrost or clean evaporator coil or replace dirty filter.
		Water regulating valve not fully open	Make sure that the required GPM of water flows through the condensing section
		Condenser coil dirty	Clean condenser coil.

ITEM CODE	PROBLEM	PROBABLE CAUSE	SOLUTION
8	Head pressure too high	Air or other non-condensable gas in system	Evacuate system and recharge. Install new filter-drier.
		Condenser air intake blocked	Clean away debris.
		Overcharge of refrigerant	Reclaim excess from high pressure side of the system.
		Condenser fan not operating	Check power to motor and ensure correct rotation of blower.
		Condenser water not circulating	Check water regulating valve and adjust for required GPM through the unit.
9	Head pressure too low	See Item 3, 4, & 7 above	Correct as indicated.
10	Suction pressure too low	Flash gas in liquid line (bubbles in sight glass) due to a leak.	Repair leak and recharge.
		Obstructed expansion valve	Repair or replace valve.
		Loss of fluid within expansion valve bulb.	Replace power head and valve.
		Clogged filter-drier	Replace with new filter-drier.
		Ice or dirt on evaporator coil	Defrost and clean evaporator coil and replace filter.
11	Heater inoperative	Thermostat set too low	Adjust thermostat to the desired temperature.
		Circuit breaker tripped or blown	Check for electrical short. Replace breaker.
		Heater high limit switch open	Insufficient air across heater elements. Check for obstructed or dirty filters.
		Heat elements burned out	Check continuity with OHM meter. Replace heater element.
12	Water carry over	Excessive air through unit	Reduce CFM to unit specifications.

ITEM CODE	PROBLEM	PROBABLE CAUSE	SOLUTION
13	System short of capacity in free cool (water coil) mode	Check for control wiring to the free cool solenoid valve.	Check wiring diagram and rewire.
14	Condensate Pump does not run	Check to see that power to the pump is present. Float not able to move freely. Dirt or algae not allowing float to activate pump.	Locate and repair electrical connection problem. Clean pump and float. Clean pump and float.
15	Condensate Pump runs with no discharge	Tubing blocked or kinked Check valve blocked Inpeller blocked Tubing elevation or run exceeds head capability	Inspect, clean or straighten as necessary. Clean check valve. Remove debris from pump impeller. Verify tubing run is within pump head limitations.
16	Lock out relay tripped	High or low pressure condition exists	Refer to items 8 & 10 above. Manually turn off system at thermostat and then back on to reset.

INSTALLATION AND SET-UP

Project: _____

Model: _____ / _____

Options _____ _____

_____ _____

_____ _____

Set Points: Cooling _____

Heating _____

RH% _____

Design: CFM _____ / _____ ESP

Voltage _____

EWT _____ GPM _____

EAT _____

OD Design _____

Controls Calibrated: Y N

Air Balance Completed: Y N

Service Agency: _____

_____

_____

_____

Date: _____

'C' SERIES
BASIC MODEL DESIGNATION

EXAMPLE:	C	5	G	3	AS	N	or	MA	10	G	3	A	10	V
	a	b	c	d	e	f		a	b	c	d	e	g	h

a. "C", "SP", "CW", "SPW", "H", "HW", "MA", "MW", "CCW", "E", or "B"

- "C" Air-Cooled Air Conditioner 2 thru 15 Tons
- "SP" Air-Cooled Air Conditioner 1 & 1.5 Tons
- "CW" Water-Cooled Air Conditioner 2 thru 15 Tons
- "SPW" Water-Cooled Air Conditioner 1 & 1.5 Tons
- "H" Air-Cooled Heat Pump 1 thru 15 Tons
- "HW" Water-Cooled Heat Pump 1 thru 15 Tons
- "MA" Air-Cooled, Microprocessor Control Unit 1 thru 15 Tons
- "MW" Water-Cooled, Microprocessor Control Unit 1 thru 15 Tons
- "CCW" Chilled Water Unit 1 thru 15 Tons
- "E" When E appears as a prefix to any of the above, it is the Evaporator Section only of the unit 1 thru 15 Tons
- "B" When B appears as a prefix to any of the above, it is the Condensing Section only of the unit 1 thru 15 Tons

b. "2", "3", "4", "5", "6", "8", "10", "12", "15" Nominal Cooling Capacity in Tons ("12" or "18" for SP units 1 & 1.5 Tons)

c. "G" Common to all

d. "1", "3", "4" or "7" Indicates Voltage

- "1" 208-230V, 1 PH
- "3" 208-230V, 3 PH
- "4" 460V, 3 PH
- "5" 575V, 3 PH
- "7" 277V, 1 PH

e. "AS", "A" or "B"

- "AS" Indicates 1 Compressor
- "A" Indicates 2 Compressors
- "B" Indicates 3 Compressors

f. "N" Only associated with 4 and 5 Ton units with single compressor, Indicates Low Height cabinet design

g. "02", "05", "10", "15", "20", "25", "30" Indicates kW Rating for Heaters

h. "V" Indicates Vertical Stacking Unit